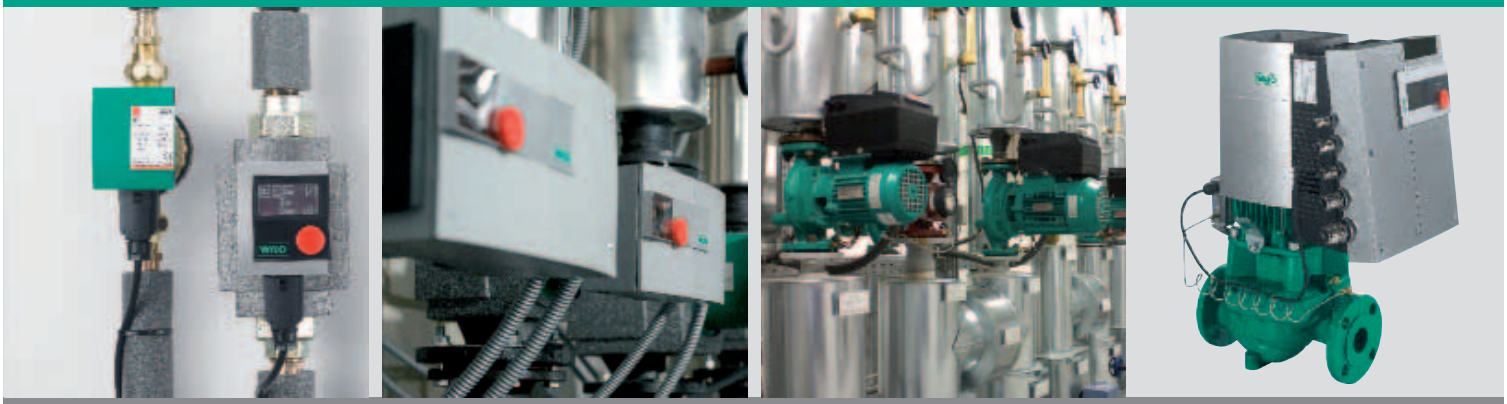
WILO

Pumpen Intelligenz.

Catalogue Building Services

Heating, Air-conditioning, Cooling

Pumps, pump systems and accessories for heating, secondary hot water, air-conditioning and cooling



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– Double pumps	Wilo-Stratos-D	C	–	–	C	C	–	–	80
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*) **Detailed information on these products can be found in the Wilo Online Catalogue.**

Key:

– Not applicable
S Single- and two-family houses
M Multi-family houses
C Commercial

☞ **New in the programme or series extension or modification**

Fields of application:

- Heating
- Secondary hot water circulation
- Floor heating
- Air-conditioning/cooling
- Solar thermal
- Geothermal
- Condensate
  Condensing boilers/air-conditioning units

Heating, air-conditioning, cooling

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	Wilo-Stratos-Z	–	M/C	M/C	C	M/C	–	–	325
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General notes and abbreviations

Abbreviation	Meaning
1~	1-phase current
3~	3-phase current
Autopilot	Automatic adjustment of pump performance during setback phases, e.g. boiler setback operation overnight
blsf	Blocking current-proof, no motor protection required
DM	Three-phase motor, 3~
DN	Nominal diameter of the flange connection
Δp	Differential pressure
Δp-c	Control mode for constant differential pressure
Δp-T	Control mode for differential pressure control depending on the fluid temperature
Δp-v	Control mode for variable differential pressure
ΔT	Control mode for differential temperature
BACnet	Internationally defined company-neutral standard for data communication in building automation systems (ISO 16484-5).
CAN	CAN (Controller Area Network) – Multi master bus system, in which several equal CAN-devices may communicate via a 2-core bus within very short cycle times. The Wilo-CAN bus includes a CANopen Standard (EN 50325-4) which is independent of the supplier.
EBM	Individual run signal
EM	Single-phase motor, 1~
ESM	Individual fault signal
EnEV	German Energy Conservation Legislation
ECM technology	Electronically commutated motor with new wet rotor encapsulation, newly developed glandless drive concept for high-efficiency pumps
Ext. Off	"Overriding Off" control input
Ext. Min	Control input "Overriding Min", e. g. for setback operation without Autopilot
FI	Residual current-operated protective device
BA	Building automation
GRD/GLRD	Mechanical seal
°dH	Degree of German water hardness; replaced by the SI unit mmol/l; conversion 1 °dh = 0.1783 mmol/l
H	Delivery head
IF	Interface
Int. MS	Internal motor protection: pumps with internal protection against unacceptably high winding temperatures
IR	Infrared interface
KDS	Capacitor
KLF	PTC thermistor sensor
Cataphoretic coating	Cataphoretic coating (electrophoretically deposited paint, EDP): paintwork with high adhesive strength for long-lasting corrosion protection
KTW	Approval for products with plastics, for utilisation in potable water applications

Abbreviation	Meaning
LON	Local Operating Network (open data bus system, standardised and independent of any single manufacturer, in LONWorks networks)
Modbus	Communication protocol based on a master/slave architecture. Ethernet and RS485 are used as the media of transmission. Widespread in industrial and building automation applications.
mmol/l	Millimols per litre; SI unit for assessing water hardness (total hardness, or concentration of alkaline earth ions)
MOT	Motor module (drive motor + impeller + terminal box/electronics module) for replacement
P_1	Power consumption (power supplied from the network)
PELV	Protective Extra Low Voltage; PELV provides extra protection from electric shock, like SELV. The voltage is so low that current flowing through the human body normally does no harm. However, unlike SELV, active parts and components of the equipment must be earthed and connected with the protective earth conductor.
PLR	Pump master computer, Wilo-specific data interface
Q (=$\dot{V}$)	Volume flow
RMOT	Spare motor (drive motor + impeller + terminal box/electronics module) for replacement
SBM	Run signal or collective run signal
SELV	Safety Extra Low Voltage; SELV (formerly "safety low voltage") is a low electrical voltage that offers extra protection against electric shocks compared to electric circuits with higher voltages due to the low voltage level and the insulation. The voltage is so low that electrical shock currents are normally not dangerous.
SSM	Fault signal or collective fault signal
Control input, 0 – 10 V	Analogue input for external control
Wilo-Control	Building automation management with pumps and accessories
TrinkwV 2001	German Drinking Water Ordinance of 2001 (valid from 01.01.2003)
VDI 2035	VDI guideline for preventing damage in hot-water heating installations
WRAS	Water Regulations Advisory Scheme (potable water approval for Great Britain and Northern Ireland)
WSK	Thermal winding contacts (in motor for monitoring the winding temperature, full motor protection through additional tripping unit)
▲	Operating mode of double pumps: Individual operation of the respective duty pump
▲+▲	Operating mode of double pumps: Parallel operation of both pumps
2	Number of poles of electric motors: 2-pole motor = approx. 2900 rpm at 50 Hz
4	Number of poles of electric motors: 4-pole motor = approx. 1450 rpm at 50 Hz
6	Number of poles of electric motors: 6-pole motor = approx. 950 rpm at 50 Hz

General notes and abbreviations

Material	Meaning	AISI
1.4021	Chromium steel X20Cr13	420
1.4034	Chromium steel X46Cr13	
1.4057	Chromium steel X17CrNi16-2	431
1.4122	Chromium steel X39CrMo17-1	
1.4301	Chromium-nickel steel X5CrNi18-10	304
1.4305	Chromium-nickel steel X8CrNiS18-9	303
1.4306	Chromium-nickel steel X2CrNi19-11	304L
1.4401	Chromium-nickel-molybdenum steel X5CrNiMo17-12-2	316
1.4408	Chromium-nickel-molybdenum steel GX5CrNiMo19-11-2	316
1.4462	Chromium-nickel-molybdenum steel X2CrNiMoN22-5-3	329 (2205)
1.4541	Chromium-nickel steel with titanium addition X6CrNiTi18-10	321
1.4542	Chromium-nickel steel with copper and niobium additions X5CrNiCuNb16-4	630
1.4571	Chromium-nickel steel with titanium addition X6CrNiMoTi17-12-2	316Ti
Abrasite	Chilled cast iron material for use in strongly abrasive fluids	
Al	Light metal material (aluminium)	
Ceram	Coating with very high adhesive strength for long-lasting corrosion protection	
Composite	High-strength plastic material	
EN-GJL	Cast iron with lamellar graphite, also referred to as grey cast iron. The use of grey cast iron in domestic water systems is governed by the Drinking Water Directive 98/83/EC and applicable recognised technical rules and standards!	
EN-GJS	Cast iron with spheroidal graphite, also referred to as spheroidal cast iron. The use of spheroidal cast iron in domestic water systems is governed by the Drinking Water Directive 98/83/EC and applicable recognised technical rules and standards!	
G-CuSn10	Zinc-free bronze	
GfK	Fibreglass plastic	
GG	See EN-GJL	
GGG	See EN-GJS	
GJMW	Special cast iron: white malleable cast iron (former designation: GTW)	
Inox	Stainless steel	
NiAl-Bz	Nickel-aluminium bronze	
PPO	Trade name: Noryl, fibreglass-reinforced plastic	
PP-GF30	Polypropylene, reinforced with 30% fibreglass	
PUR	Polyurethane	
SiC	Silicon carbide	
St	Steel	

Material	Meaning	AISI
V2A	Material group, e.g. 1.4301, 1.4306	304
V4A	Material group, e.g. 1.4404, 1.4571	316

Wear and tear

Pumps or parts of pumps are subject to wear in accordance with state-of-the-art technology (DIN 31051/DIN-EN 13306). This wear may vary depending on operating parameters (temperature, pressure, speed, water conditions) and the installation/usage situation and may result in the malfunction or failure at different times of the aforementioned products/components, including their electrical/electronic circuitry.
Wearing parts are all components subject to rotary or dynamic stress, including electronic components under tension, in particular:

- Seals (including mechanical seals), seal rings
- Stuffing boxes
- Bearings and shafts
- Impellers and pump components
- Wear rings and counter rings
- Stationary wear rings / wear plates
- Macerator
- Capacitor
- Relays / contactors / switches
- Electronic circuits, semiconductor components, etc.

Pumps and continuous-flow machines (like submersible mixers and recirculation pumps), as well as their components with coatings (cataphoresis coating, 2K- or Ceram-coating) are subject to constant wear due to the abrasive fluid contents. For this reason the coating is also among the wearing parts of these units.

We do not accept any liability for faults or defects arising from natural wear and tear.

Note

In accordance with **German Energy Saving Ordinance [Energieeinspar-Verordnung EnEV]** as of the 1.2.2002 at boiler outputs from 25 kW, heating pumps are to be equipped with switchgears for automatic performance control or **electronically controlled pumps** are to be installed.
In accordance with **TrinkwV 2001** and **DIN 50930-6**, only circulating pumps with corrosion-resistant pump housings made of stainless steel or red brass (CC 499K) are to be utilized in secondary hot water circulation systems.

Pump replacement

Detailed information on the subject of “Replacing heating pumps” can be found in the current Wilo replacement guide for heating pumps.

Wilo – General Terms of Delivery and Service

The latest version of our General Terms of Delivery and Service can be found on the Internet at

www.wilo.com/agb

Pump selection: General remarks

Circulation pumps should always be selected so that the specified duty point is located at or as near as possible to the point of maximum efficiency (optimum volume flow) of the maximum speed H/Q pump curve.

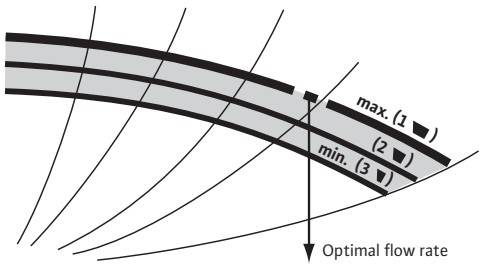


Fig.: Pump curve

If the specified duty point lies between two pump curves, then the smaller pump is always to be selected:

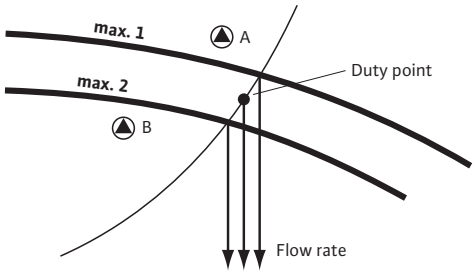


Fig.: Pump selection

The resulting volume flow reduction has no appreciable effect on the actual heating output in heating systems. This applies to pumps for cooling systems.

Pump selection: Secondary hot water circulation systems

Pump selection

- In order to ensure the correct configuration of the secondary hot water circulation system, the pipe system must be designed in accordance with DIN 1988 as well as DVGW worksheets W 551 to W 553.
- The volume flow should be determined according to the specifications in the standard and the DVGW guideline.
- If the hydraulic duty point is between two pump curves, then the next largest circulation pump or speed stage is to be selected in accordance with DVGW worksheet W 553.
- The heat losses in the ascending and circulation secondary hot water pipes are to be reduced to a minimum by appropriate insulation.

Since most secondary hot water circulation systems permit periodic circulation pump deactivation (as a rule at night), a clock timer should be included in the standard equipment for automatic ON/OFF operation.
The German energy savings ordinance (EnEV) demands periodic pump activation/deactivation. Legionellae switching of the heat generator or the heating controller are to be observed and taken into account during programming.

Maximum secondary hot water temperature

In view of the hardness-forming components contained in the water, secondary hot water circulation systems should not be operated at temperatures above 65 °C.
This limit is required to avoid the formation of lime deposits.

Circulation pipe

Wilo recommends the installation of a check valve in order to prevent faulty circulation and to prevent gravity circulation in pumps that have been shut down.

Variable speed control

Experience shows that variable speed control is only required in circulation pumps in secondary hot water circulation systems for the basic adjustment of the performance. An automatic speed control is not required. A time-dependent activation/deactivation should however be provided for each installation.

Motor protection

Blocking current-proof pumps and pumps with internal protection against unacceptably high winding temperatures do not require motor protection. All other pumps have integrated full motor protection including trip electronics or full motor protection (WSK) in conjunction with an external tripping unit.

Pump duty splitting

General notes on double pumps

- Two pump heads mounted in a common housing, hydraulically separated by a switchover valve
- Specific design characteristics like with corresponding single pump series
- Replacement of an equally powerful single pump with identical installation dimensions
- Wide range of applications due to standard 3-stage switching

Pump duty splitting

Splitting the assigned maximum design output to a **double pump in parallel operation** enables - particularly in terms of heating - significantly improved **adaptability to partial-load conditions** and **optimum economic efficiency**. The partial-load pump output to be achieved on average during the season, i.e. for more than 85% of the heating season is sufficient for the operation of **one pump only**; **the second pump** is available for **parallel operation** for occasional full-load requirements.

Benefits of splitting the output between two pumps:

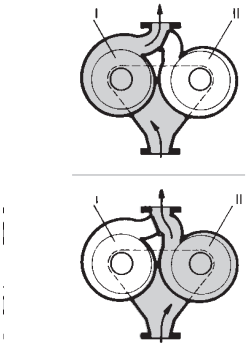
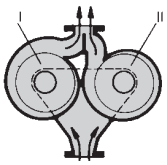
- Reduction of the operating costs by between 50% and 70%
- Increased reliability due to the constant availability of a standby unit ready for operation

The individual performance maps for double pumps featured in the relevant chapters specify the hydraulic performance values for both individual and parallel operation.

Operating modes for double pumps

Double pumps are suitable for operation in either of two basically different operating modes:

- Main/standby mode
- Parallel operation

Main/standby mode (RESERVE)	Parallel operation (ADDITION)
	
Pump I or Pump II in operation	Both pumps in operation
The version-specific pump output is provided by whichever one of the two pumps is acting as the main pump; the second pump remains on standby, ready for time- or fault-actuated switchover.	The version-specific pump output is provided by both pumps operating in parallel. One pump can be switched off during partial-load operation.

Flow rates in pipe and pump

The flow rate of the fluid in the pipework is determined by the cross-section sizes. The values listed below should not be exceeded:

Nominal connection diameter DN [Ø mm]	Flow rate v [m/s]
In building installations	
Up to Rp 1¼ or DN 32	Up to 1.2
DN 40 and DN 50	Up to 1.5
DN 65 and DN 80	Up to 1.8
DN 100 and greater	Up to 2.0
In long-distance heating pipes	2.5 to a maximum of 3.5

The flow rates [m/s] in the pump are specified in all duty charts for Wilo pumps as a function of the pump output.

Viscous fluids

All pump curves included in the catalogue apply to the pumping of water (kinematic viscosity = 1 mm^2/s). If fluids of different density and/or viscosity are pumped (e.g. water-glycol mixtures), the hydraulic values of the pump and the pipe system will deviate. Documents on the **calculation of the correction values for the selection of the pumps** can be obtained from Wilo.
Correction values for the pipe system (increased pressure loss, specific thermal output deficit) cannot be provided by the pump manufacturer. They must be calculated by the planning engineer in cooperation with the chemical additive suppliers and the manufacturers of the valves.

Minimum inlet pressure for the prevention of cavitation

To prevent cavitation (vapour bubble formation within the pump), it is necessary to maintain a sufficiently high over pressure (suction head) at the pump suction port in relation to the vapour pressure of the fluid being pumped.
The minimum suction heads are listed in the respective tables for all glandless pumps. These guidance values apply for heating systems up to 110 °C/130 °C feed temperature and installation location up to 300 m above sea level. Addition for higher altitudes: 0.1 m/100 m height increase.
The values must be increased accordingly when pumping fluids of higher temperatures or lower densities, where there is greater flow resistance on the pump suction side, and in regions of lower atmospheric pressures.

Notes on installation and operation

Permitted ambient temperature: 0 °C to +40 °C

Installation

Installation inside a building

Glandless pumps must be installed in dry, well-ventilated, frost-free rooms.

Installation outside a building (outdoor installation)

The glandless pumps of the following series are suitable for outdoor installation:

- Wilo-Stratos/-D
- Wilo-TOP-S/-SD
- Wilo-TOP-RL

The following conditions must be complied with:

- Installation of the pump in a sump (e.g. light sump, ring sump) with cover or in a cabinet/housing for protection against the weather
- Avoidance of direct sunlight on the pump
- Protection of the pump against rain. Dripping water from above is permitted provided that the electrical connection has been established in accordance with the installation and operating instructions and the terminal box has been properly sealed
- Provide adequate ventilation/heating in situations where the permitted ambient temperature is exceeded or fallen short of
- Permissible ambient temperature for outdoor installation:

Stratos/-D:	-10 °C to +40 °C
TOP-S/-SD:	-20 °C to +40 °C
TOP-RL:	-20 °C to +40 °C

Condensation water

All standard pumps for cold water operation that are intended for applications up to -10 °C/-20 °C are fully condensation-proof. The grey cast iron pump housing of the following series is used for surface finishing:

- Stratos/Stratos-D
- TOP-S/-SD
- TOP-D

with a special coating (KTL: (cataphoretic coating).
The benefits of this coating are:

- Optimum corrosion protection against condensation formation on the pump housings in cold-water installations
- Very high scratch and impact resistance

Intermittent operation

The series

- Stratos/Stratos-D/Stratos-Z/Stratos-ZD
- Stratos PICO/ECO
- Star-RS/RSD
- TOP-S/-SD
- TOP-D
- TOP-Z

can also be used for intermittent operation.

Operating pressure

The maximum system pressure (operating pressure) and the flange versions for the pumps are listed in the relevant tables. All flanges on glandless pumps (except Stratos, Stratos-Z, Stratos-D and Stratos-ZD) have pressure-measurement connections R $^{1}/_{8}$

Connections

Screw-end pumps

Screw-end pumps are equipped with connecting threads in accordance with DIN EN ISO 228, Part 1. Seals are included in the scope of delivery.
Pipe unions with pipe thread in accordance with DIN EN 10226-1 must be ordered separately.

DIN 2999 (pipe thread sealing in the thread)	DIN EN ISO 228/1 (sealing pipe thread with flat gasket on longitudinal side)
Female pipe thread Rp 1½	Female pipe thread G 1½
Male pipe thread R 1½	Male pipe thread G 1½

Flange-end pumps

The pump flanges are designed in accordance with DIN 2531, DIN 2533 or DIN EN 1092-2. Detailed information is provided for the respective pump series.

Combination flange pumps

Flange-end pumps with combination flanges can be mounted with counter flanges PN 6 and PN 16 in accordance with DIN or DIN EN up to and including DN 65. The installation of a combination flange with a combination flange is not permitted. Screws with a tensile strength class of 4.6 or higher must be used for the flanged connections. The washers included in the scope of delivery must be fitted between heads of the screws/nuts and the combination flange.
Recommended screw lengths:

Thread	Tightening torque	Minimum screw length	
		DN 32/DN 40	DN 50/DN 65
Flange connection PN 6			
M12	40 Nm	55 mm	60 mm
Flange connection PN 10			
M16	95 Nm	60 mm	65 mm

Motor

Glandless pump motors with protection class:

• Wilo-Stratos series	44
• Wilo-Star series	44
• Wilo-TOP range	44
• Remaining pump range	IP 42
• Insulation class	F/H
• Emitted interference	EN 61000-6-3
• Interference resistance	EN 61000-6-2

Electrical connection

- All Wilo pumps are made for a voltage of 230 V or 400 V (tolerance ±10%) in accordance with DIN IEC 60038.
- All Wilo pumps made after 1 January 1995 have been labelled with the CE marking in accordance with the EU Machinery Directive.
- When pumps are used in systems with fluid temperatures above 90 °C, a suitably heat-resistant connecting pipe must be used.

Electronic performance control

Heating pumps are, due to their high annual operating hours, among the largest power-consuming appliances in buildings.
Automatic pump performance control helps drastically to reduce power consumption in heating pumps. Reductions of up to 50% can thus be achieved. Compared to standard pumps, high-efficiency pumps can even save up to 80% electricity costs.
All operating states, in particular in the partial load range that is typical for heating systems, can be optimised hydraulically by means of automatic pump performance control.
A further significant effect connected with the prevention of a rise in pump pressure is the avoidance of flow noise in thermostatic valves.

German Energy Savings Ordinance, EnEV

In the context of the legal measures for the reduction of CO_2emissions, with regard to the electricity consumption of heating circulation pumps, the legislator has stipulated in the EnEV (as amended on October 1, 2009) that circulation pumps in central heating system with a nominal thermal output exceeding 25 kW must be equipped in such a way that the electrical power consumption is automatically adjusted to the specific pumping operation requirements in at least three stages.
Even though the EnEV does not demand the use of an automatic pump output controller for pumps with a nominal thermal output below 25 kW, it is nevertheless the case that by far the greater potential savings in terms of electricity and CO_2 are to be found in the one- and two-family house sector, i.e. with installations below 25 kW.
The pump output controller does not replace the need for the correct dimensioning of the circulation pump. The installed pump output must also be checked when the pump is replaced. Controlled pumps that are slightly overdimensioned do not pose any risk if they are correctly set to the nominal load requirement.

Standards/directives

- CE marking (all Wilo pumps)
- Certification according to:
  - DIN EN ISO 9001.
  - DIN EN ISO 14001

Pump curves

The pump curves apply to water at +20°C and a kinematic viscosity of 1 mm^2/s.
The pump curves take the European voltages of 230 V and 400 V into account.

Pump control

When Wilo pumps are operated with control devices or module accessories, the electrical operating conditions in accordance with VDE 0160 are to be complied with.
When operating glandless and glanded pumps with brands of frequency converters other than those supplied by Wilo, output filters for reducing motor noise and for preventing harmful voltage peaks are to be used and the following limit values are to be complied with:

- Glandless pumps with $P_2 \leq 2.2$ kW and glanded pumps with $P_2 \leq 1.1$ kW
  rate of voltage rise du/dt < 500 V/µs
  voltage peaks û < 650 V
  For glandless pump motors, sine filters (LC filters) are recommended for noise reduction instead of du/dt filters (RC filters).
- Glanded pumps with $P_2 > 1.1$ kW
  rate of voltage rise du/dt < 500 V/µs
  voltage peaks û < 850 V

Installations with long cable lengths (l > 10 m) between converter and motor may increase the du/dt and û levels (resonance). The same applies to operation with more than 4 units using a common power supply. The output filters must be designed by the manufacturer of the frequency converter or the filter supplier. If losses in the motor are caused by the frequency converter, the pumps are to be run at a maximum of 95 % of their nominal speed. If glandless pumps of the TOP-S/-SD, TOP-D and TOP-Z series are operated on one frequency converter, the following limit values at the connection terminals of the pumps must not be fallen short of:
U_{min} = 150 V
f_{min} = 30 Hz

Minimum volume flow

Larger pumps require a minimum flow rate to ensure trouble-free operation. Operating against a closed slide valve, volume flow Q = 0 m^3/h, can lead to overheating inside the pump.

- Limit conditions for pump operation at Q = 0 m3/h:
  up to P_2 = 1 kW are unproblematic if the fluid temperature is 10 K below the maximum permissible fluid temperature.
- Above P_2 > 1 kW permanent operation, a minimum volume flow of Q = 10 % Qnominal is required
  For the limit ranges, please consult Wilo.

Motor protection

Service life and operational reliability of a circulation pump depend to a great extent on the choice of the correct motor protection. The selection of the correct motor protection is a decisive factor for the service life and operational reliability of a circulation pump. Motor protection switches are no longer suitable for multi-speed pumps, since their motors have deviating nominal currents in the different stages, which require fuses for each of these stages.
All circulation pumps are either

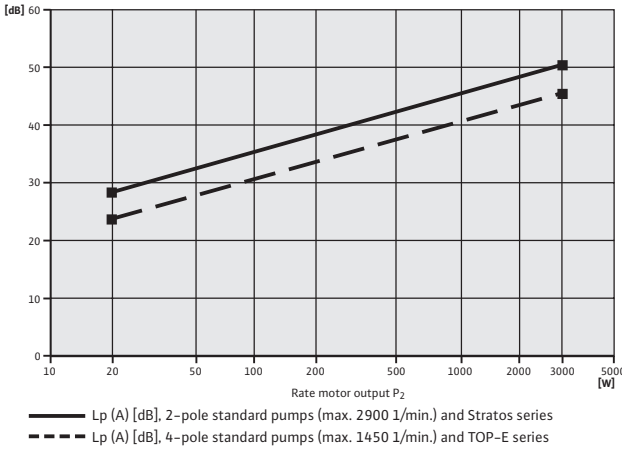
- blocking current-proof
- provided with internal protection against unacceptably high winding temperatures
- with full motor protection by thermal winding contact (WSK) and separate external tripping unit
- with full motor protection by an integrated tripping mechanism

For the exact equipment, see the “Motor data” table.

No other motor protection is required by the customer, unless demanded by the regional electricity supply company.

Sound pressure level

Glandless pumps are low-noise due to their design. Their air-borne noise values with measuring-surface sound pressure level Lp (A) [dB] depend on the motor power output, and are determined under normal operating conditions.



Thermal insulation for heating applications

All Wilo-Stratos/Stratos-Z, Wilo-TOP-E/-S/-Z/-D and Stratos PICO/ECO single pumps are equipped as standard with insulating shells in order to prevent heat losses from the pump housing.
Material: EPP, polypropylene foam
Thermal conductivity: 0.04 W/m K in accordance with DIN 2612
Flammability: Class B2 in accordance with DIN 4102; FMVSS 302
When insulating the pump onsite, care must be taken to cover the pump up to the top edge of the pump housing only (the motor must be left uncovered).

Insulation for air-conditioning/cooling applications

If pumps from the series
- Stratos, Stratos-D, Stratos-Z
- TOP-S/-SD
- TOP-D
- TOP-Z
- TOP-RL

are used in air-conditioning/cooling applications, no diffusion-proof insulation is permitted to cover the drain labyrinth between the pump housing and the motor. That ensures that any condensate having possibly accumulated in the motor can drain off freely through the condensate drain openings in the motor housing.
The Wilo-ClimaForm diffusion-proof insulation available as accessory for the Stratos, TOP-S and TOP-RL series for the insulation of pump housings in cold water applications ensures this automatically due to its specific design.

Wilo-ClimaForm:
- Water vapour diffusion resistance μ > 7000
- Normal flammability, in accordance with DIN 4102-B2
- Part 1 Quality monitoring in accordance with DIN 18200

Quality and safety marks

For pump types:
- Stratos PICO
- Stratos ECO
- Star-RS 25/..., -RS 30/...,
- Star-RSD 30/...,
- Star-Z NOVA, Star-Z 20/1, -Z 25/6

Certificate of conformity

Available on request at additional charge for all glandless circulation pumps of the series:
- Stratos, Stratos-D, Stratos-Z, Stratos-ZD
- TOP-S/-SD
- TOP-D
- TOP-Z
- **Certificate of conformity 2.1**
  Content: Certification that the supplied product complies with the order, without details of test results.
- **Certificate of conformity 2.2**
  Content: Certification that the supplied product complies with the order, with details of series test results.
- **Acceptance test certificate 3.1**
  Content: Certification that the supplied product complies with the order, with details of test results actually measured on the product. The required test scope must be specified in advance.

Planning guide

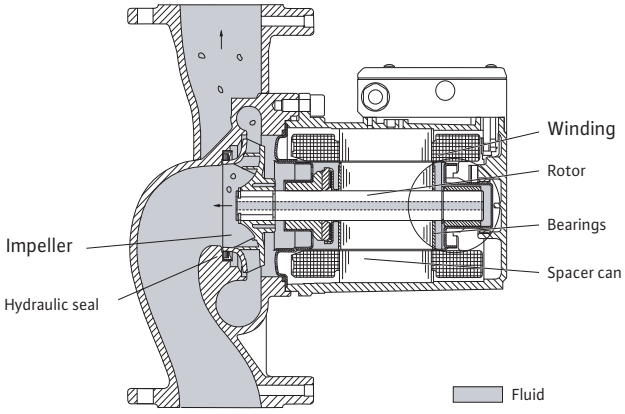
Glandless pumps (general)

Special versions

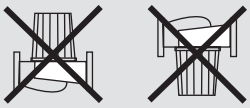
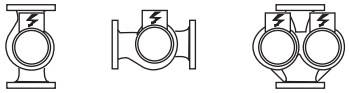
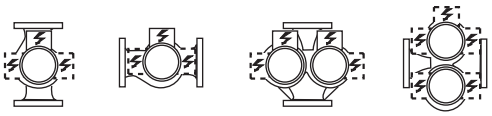
Pumps for other voltages or 60 Hz frequency possible on request (at additional charge).
Other materials and versions (RG, PN 16) for pumps are listed in the pump tables.

The glandless circulation pump

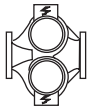
With this design, all rotating components inside the canned motor run in the pumped fluid. The required shaft seal in conventional pump types achieved by the use of stuffing boxes or mechanical seals is omitted. The pumped fluid lubricates the shaft bearings and cools the components of the electric motor.
The electrical part of the pump motor (stator with winding) is separated from the encapsulated rotor compartment by means of an encapsulated motor cartridge (with the TOP Wilo series) and/or by a can sealed off with O-rings.



Installation positions for glandless pumps

Installation positions not permitted	Permitted without restrictions All energy-saving pumps, infinitely variable control	Permitted without restrictions All standard and secondary hot water circulation pumps, 1 or 3 speed stages
		

Additional terminal box positions for single and double pumps

Pump types								
TOP-E 25 (30)/1-7 TOP-E 30/1-10 TOP-E 40/1-4 TOP-E 50/1-6	•	–	•	–				
TOP-ED 32/1-7 TOP-ED 40/1-7 TOP-ED 50/1-6	–	–	–	–	•	–	–	•
Star-RS, Star-Z, Smart	•	•	•	•	–	–	–	–
Stratos ECO-Z	•	–	•	–	–	–	–	–
Star-RSD	–	–	–	–	•	•	•	•
Stratos PICO	•	–	•	–	–	–	–	–
Stratos ECO	•	–	•	–	–	–	–	–

Install pumps under stress-free conditions. Valid for all operating conditions.
Please ask Wilo.

Connection of Wilo-TOP... and -Stratos... to Wilo switchgear provided by the customer

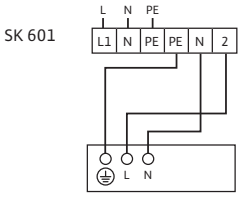
Connection of Wilo-TOP... and Stratos ... to Wilo switchgear provided by the customer

Available Wilo switchgear	New pump type															
	Switchgear connection possible according to wiring diagram														Accessories: Modules	
															Wilo-IF-Module single-phase current	
	Wilo-TOP-S Wilo-TOP-Z Wilo-TOP-RL				Wilo-TOP-SD or 2 x Wilo-TOP-S 2 x Wilo-TOP-Z 2 x Wilo-TOP-RL				Wilo-TOP-D				Wilo-TOP-E Stratos Stratos-Z	Wilo-TOP-ED Stratos-D Stratos-ZD or 2 x TOP-E 2 x Stratos 2 x Stratos-Z	Wilo-TOP-E Stratos Stratos-Z	Wilo-TOP-ED Stratos-D Stratos-ZD or 2 x TOP-E 2 x Stratos 2 x Stratos-Z
	1~		3~		1~		3~		1~		3~		1~	1~	1~	1~
	IP	WSK SSM	IP	SSM	IP	WSK SSM	IP	SSM	IP	WSK	IP	WSK				
SK 601	A	B	C [1]	D [1]	A	B	C [1]	D [1]	T	V	X [1]	Y	S	S	Yes	Yes
SK 602/622	F	C	H	I	F	C	H	I	U	W	X1	Y1	J	J	Yes	Yes
SK 632	–	–	K	L	–	–	K	L	–	–	K	L	–	–	Yes	Yes
S2R 3D	–	–	–	–	M	N	o	P	–	–	–	–	–	Q or R	Yes	Yes
AR/DR/CR	–	–	–	S	–	–	–	S	–	–	–	–	–	–	–	–

IP: Internal protection against unacceptably high winding temperatures, WSK: Thermal winding contacts SSM: Collective fault signal

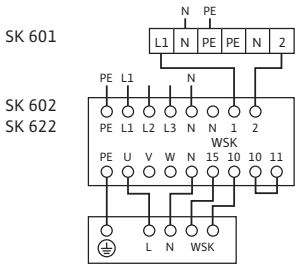
– = connection not possible,
[1] Only in conjunction with contactor and/or Wilo-SK 602/622; SK602/622 can also be used as On/Off switch or contactor

Wiring diagram A
power supply 1~230 V/N/50 Hz



1) Wilo-TOP-S/-Z/-SD/-RL

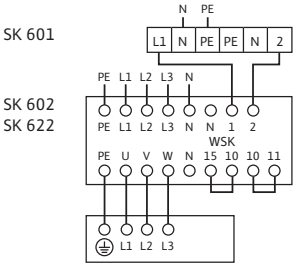
Wiring diagram B
power supply 1~230 V/N/50 Hz



1) 3) Wilo-TOP-S/-Z/-SD

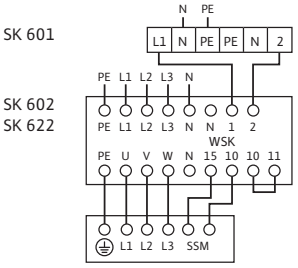
Connection of Wilo-TOP... and -Stratos... to Wilo switchgear provided by the customer

Wiring diagram C
power supply 3~400 V/N/50 Hz



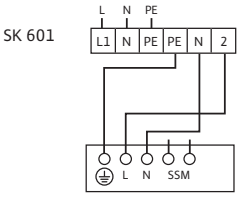
1) 3) Wilo-TOP-S/-Z/-SD

Wiring diagram D
power supply 3~400 V/N/50 Hz



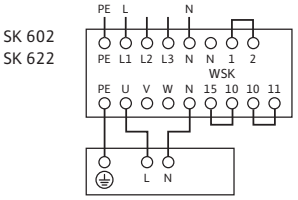
1) 2) 3) Wilo-TOP-S/-Z/-SD

Wiring diagram E
power supply 1~230 V/N/50 Hz



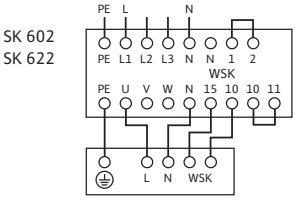
1) Wilo-TOP-E/-ED
Wilo-Stratos/-Z/-D/-ZD

Wiring diagram F
power supply 1~230 V/N/50 Hz



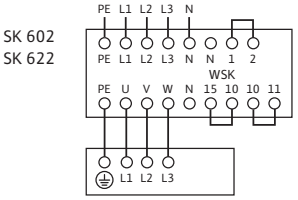
1) Wilo-TOP-S/-Z/-SD/-RL

Wiring diagram G
power supply 3~400 V/N/50 Hz



1) 3) Wilo-TOP-S/-Z/-SD

Wiring diagram H
power supply 3~400 V/N/50 Hz

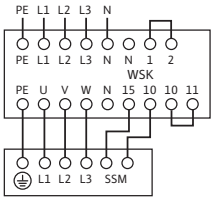


1) Wilo-TOP-S/-Z/-SD

Connection of Wilo-TOP... and -Stratos... to Wilo switchgear provided by the customer

Wiring diagram I
power supply 3~400 V/N/50 Hz

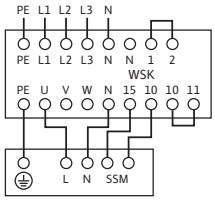
SK 602
SK 622



1) 2) 3) Wilo-TOP-S/-Z/-SD

Wiring diagram J
power supply 3~400 V/N/50 Hz or 1~230 V/N/50 Hz

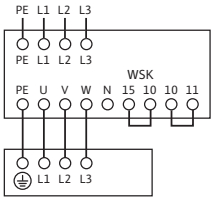
SK 602
SK 622



1) 2) 3) Wilo-TOP-E/-ED
Wilo-Stratos/-Z/-D/-ZD

Wiring diagram K
power supply 3~400 V/N/50 Hz

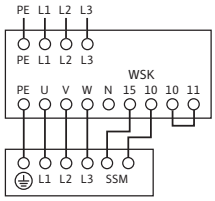
SK 632



1) Wilo-TOP-S/-Z/-SD

Wiring diagram L
power supply 3~400 V/N/50 Hz

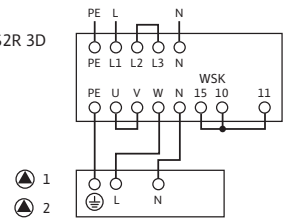
SK 632



1) 2) Wilo-TOP-S/-Z/-SD

Wiring diagram M
power supply 1~230 V/N/50 Hz

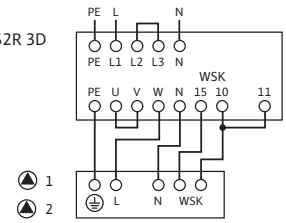
S2R 3D



1) 3) Wilo-TOP-S/-Z/-SD/-RL
Wilo-SE/SE-TW

Wiring diagram N
power supply 1~230 V/N/50 Hz

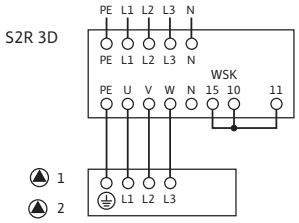
S2R 3D



1) Wilo-TOP-S/-Z/-SD

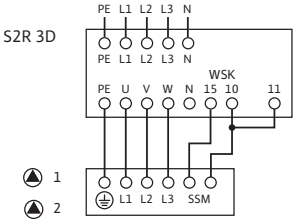
Connection of Wilo-TOP... and -Stratos... to Wilo switchgear provided by the customer

Wiring diagram O
power supply 3~400 V/N/50 Hz



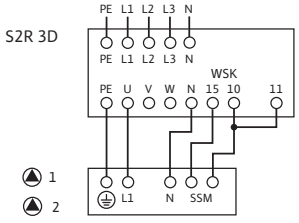
1) Wilo-TOP-S/-Z/-SD

Wiring diagram P
power supply 3~400 V/N/50 Hz



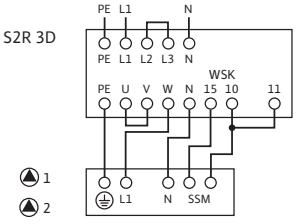
1) 2) Wilo-TOP-S/-Z/-SD

Wiring diagram Q
power supply 3~400 V/N/50 Hz



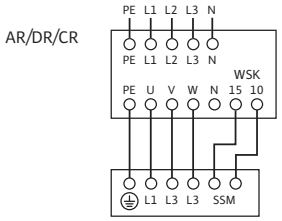
1) 2) Wilo-TOP-E/-ED
Wilo-Stratos/-Z/-D/-ZD

Wiring diagram R
power supply 1~230 V/N/50 Hz



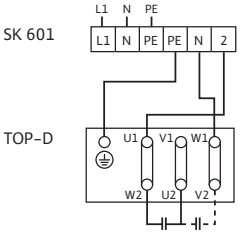
1) 2) Wilo-TOP-E/-ED
Wilo-Stratos/-Z/-D/-ZD

Wiring diagram S
power supply 3~400 V/N/50 Hz



1) Wilo-TOP-S/-Z/-SD

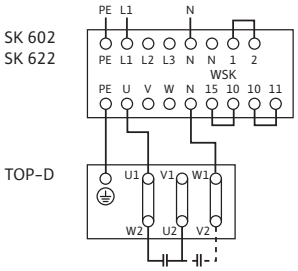
Wiring diagram T
power supply 1~230 V/N/50 Hz



1)

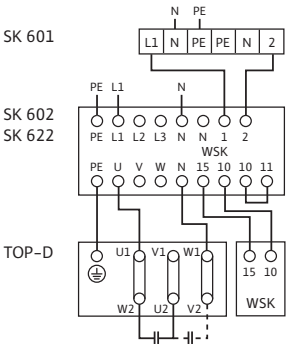
Connection of Wilo-TOP... and -Stratos... to Wilo switchgear provided by the customer

Wiring diagram U
power supply 1~230 V/N/50 Hz



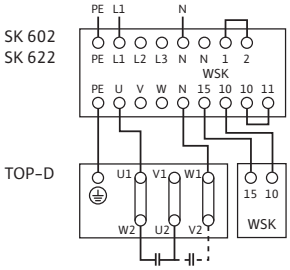
1)

Wiring diagram V
power supply 1~230 V/N/50 Hz



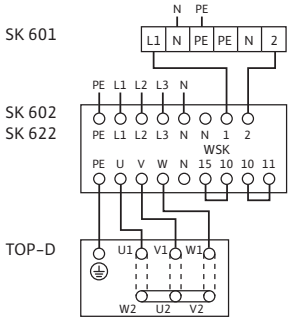
1) 3)

Wiring diagram W
power supply 1~230 V/N/50 Hz



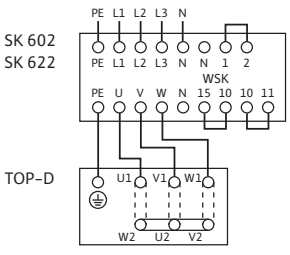
1) 3)

Wiring diagram X
power supply 3~400 V/N/50 Hz



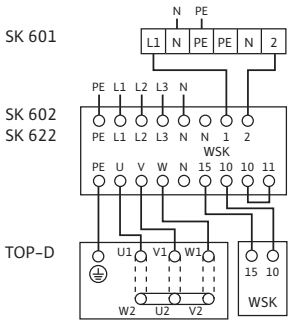
1) 3)

Wiring diagram X1
power supply 3~400 V/N/50 Hz



1)

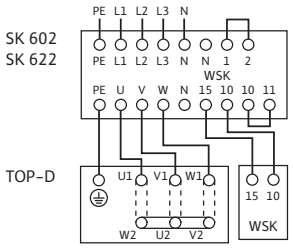
Wiring diagram Y
power supply 3~400 V/N/50 Hz



1) 3)

Connection of Wilo-TOP... and -Stratos... to Wilo switchgear provided by the customer

Wiring diagram Y1
power supply 3~400 V/N/50 Hz



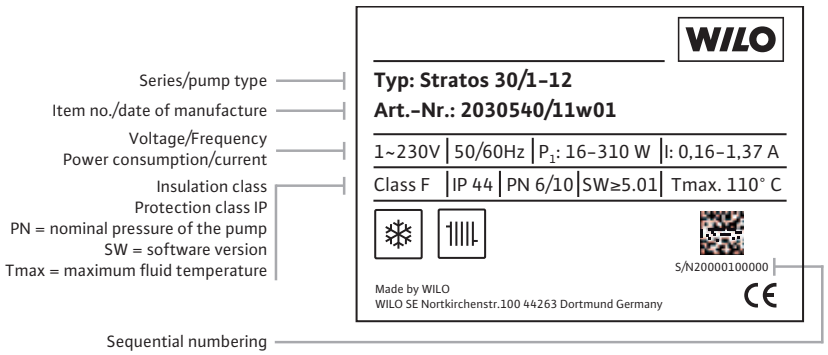
1) 3)

1) Automatic restart after a power failure
2) After an overload fault trip of the pump (TOP or Stratos), acknowledge the fault first at the pump, then at the switchgear
3) SK 622 additionally with terminals for collective run signals and collective fault signals.
   On replacing a three-phase pump (3~400 V) with a single-phase pump (1~230 V) ensure protective multiple earthing.

Consultation with Wilo is required when installing Wilo pumps in conjunction with Wilo switchgears not listed or with switchgears not supplied by Wilo. For terminal circuit diagrams for Wilo circulation pumps, see the "Service/accessories" chapter or the pump data.

Glandless pumps

Name plate designation of the Wilo-Stratos series

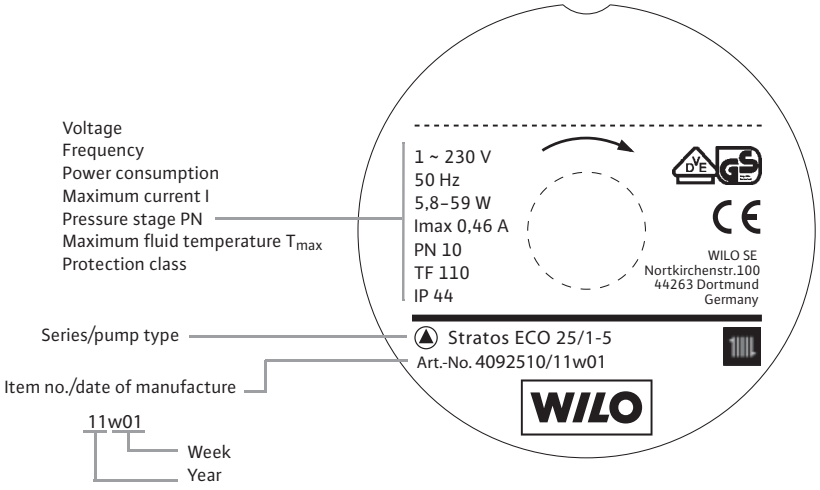

Series/pump type
Item no./date of manufacture
Voltage/Frequency
Power consumption/current
Insulation class
Protection class IP
PN = nominal pressure of the pump
SW = software version
Tmax = maximum fluid temperature
Sequential numbering
WILO
Typ: Stratos 30/1-12
Art.-Nr.: 2030540/11w01
1~230V | 50/60Hz | P1: 16-310 W | I: 0,16-1,37 A
Class F | IP 44 | PN 6/10 | SW≥5.01 | Tmax. 110° C
S/N20000100000
Made by WILO
WILO SE Nortkirchenstr.100 44263 Dortmund Germany

Series design

Series code for the Wilo-Stratos range

Type Wilo...	Version
	High-efficiency pumps, infinitely variable speed
Stratos	Single pump
Stratos-D	Double pump
Stratos-Z	Single pump for secondary hot water circulation systems
Stratos-ZD	Double pump for secondary hot water circulation systems

Rating plate identification Wilo-Stratos PICO/ECO, Wilo-Star



Series design

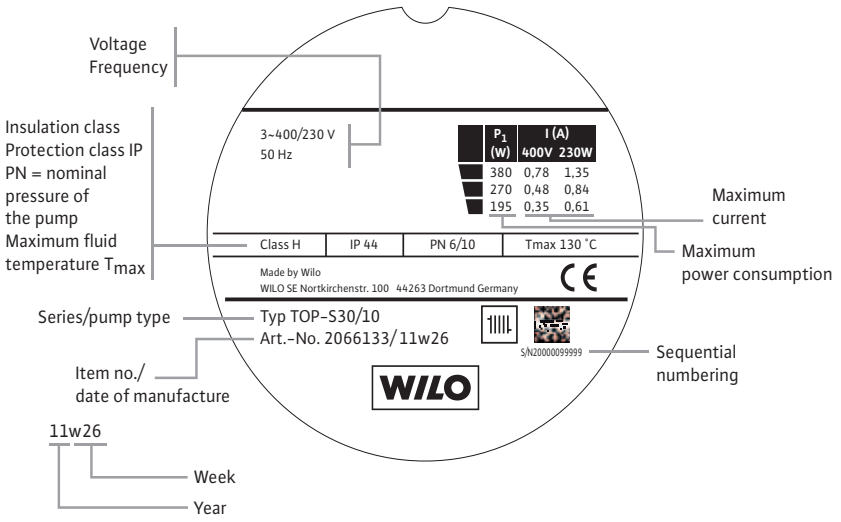
Series abbreviation for the programmes Wilo-Star and Wilo-Stratos PICO/ECO

Type Wilo...	Version
	High-efficiency pumps, infinitely variable speed
Stratos ECO Stratos PICO	Single pump
	Standard pump, 3 speed stages
Star-RS	Single pump
Star-RSD	Double pump
Star-RSL	Ventilation pump
	Secondary hot water circulation pumps
Stratos ECO-Z Star-Z NOVA	Single pump in high-efficiency version
Star-Z	Single pumps, 1 or 3 speed stages
	Solar thermal pumps
Stratos ECO-ST	Single pump, high-efficiency version for solar thermal systems
Star-ST	Single pumps, 3 speed stages, for solar thermal systems
Star-RSG	Single pumps, 3 speed stages, for geothermal energy systems

Designation key

Glandless pumps

Name plate designation of the Wilo-TOP range



Series design

Series code for the Wilo-TOP range

Type Wilo...	Version
	Energy-saving pumps, infinitely variable speed
TOP-E	Single pump
TOP-ED	Double pump
	Standard pumps, 2 or 3 speed stages
TOP-S/-RL	Single pump
TOP-SD	Double pump
	Standard pumps, 1 speed stage
TOP-D	Single pump
	Circulation pumps for secondary hot water circulation systems, 3 speed stages
TOP-Z	Single pump

Name plate designation of special versions

On request, some pumps can be supplied in the following special versions at additional charge (the type of the special version is indicated on the name plate):

- **130** Pump with short overall length
- **RG** Red brass version

Example

Type Wilo...	Special version
Star-RS 25/4 RG	Star-RS 24/4 with red brass housing

Glandless pumps

Energy efficiency class

In the context of the Kyoto Agreement, European governments in particular are pursuing the goal of drastically reducing CO_2 emissions. Energy labelling, particularly for high-consumption household devices such as washing machines and refrigerators, is prescribed as an important control element for providing the end consumer with an aid for making decisions in favour of energy-saving appliances.
Due to the fact that heating circulation pumps are among the biggest individual electricity consumers in household use because of their long running times, leading European heating pump manufacturers have voluntarily declared their intention of henceforth attaching energy labels to their heating pumps. This makes it possible for users and end consumers to recognise, on the basis of an already familiar classification system, whether a heating circulation pump in use is particularly energy-efficient.
The classification of the energy efficiency of heating pumps is carried out by means of a technical measuring procedure, which provides the Energy Efficiency Index, EEI. The smaller the EEI, the less electrical energy the pump consumes and the more favourable the energy classification.

Energy class	Energy Efficiency Index
A	EEI < 0.4
B	0.4 ≤ EEI < 0.6
C	0.6 ≤ EEI < 0.8
D	0.8 ≤ EEI < 1.0
E	1.0 ≤ EEI < 1.2
F	1.2 ≤ EEI < 1.4
G	1.4 ≤ EEI

Table: Classification of the Energy Efficiency Index in 7 different energy categories.

The following tables list the corresponding energy class for all heating pumps to be labelled, which is incorporated in the energy label on the packaging. In accordance with the lettering system familiar from household appliances, A is the best possible and G is the worst possible of the energy classes.
A comparison of hydraulically similar pumps with different energy classifications reveals that there is a difference of approximately 22% in terms of energy consumption between two sequentially numbered energy classes. Accordingly, an energy class A pump requires on average only around 33% of the electrical energy consumed by a class D pump.
Even though the energy requirements of a class A pump are very high, high-efficiency energy class A pumps have in the meantime become available for use throughout the entire performance range from single-family houses to large buildings.

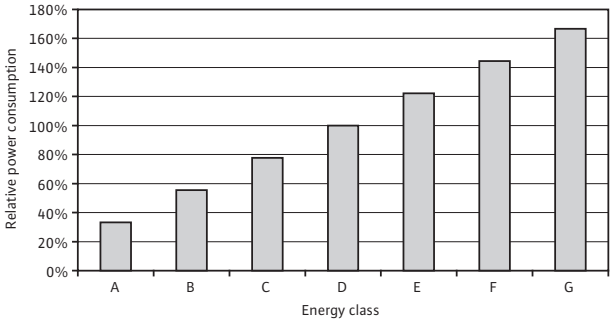


Fig.: Comparison of the energy consumption rates of pumps with the same hydraulic output

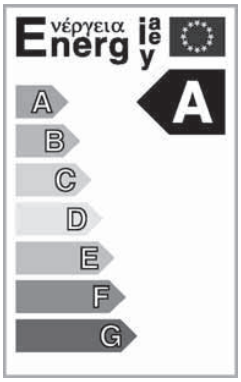


Fig.: Energy label for heating circulation pumps, Example: Energy class A

Glandless pumps

EEI classification – Single pumps/double pumps (field of application: single and two-family house)

Nominal diameter	Wilo-Stratos PICO...	EEI class	Wilo-Stratos ECO...	EEI class	Wilo-Smart...	EEI class	Wilo-Star-RS...	EEI class	Wilo-Star-RSD...	EEI class
DN 15 (Rp ½)	15/1-4	A	–	–	15/4	B	15/4	B	–	–
	15/1-6	A	–	–	15/6	B	15/6	C	–	–
DN 25 (Rp 1)	25/1-4	A	25/1-5	A	25/4	A	25/2	C	–	–
	25/1-6	A	–	–	25/6	B	25/4	B	–	–
	–	–	–	–	–	–	25/6	C	–	–
	–	–	–	–	–	–	25/7	D	–	–
	–	–	–	–	–	–	25/8	D	–	–
DN 30 (Rp 1 ¼)	30/1-4	A	30/1-5	A	30/4	A	30/2	C	30/4	D
	30/1-6	A	–	–	30/6	B	30/4	B	30/6	D
	–	–	–	–	–	–	30/6	C	–	–
	–	–	–	–	–	–	30/7	D	–	–
	–	–	–	–	–	–	30/8	D	–	–

EEI classification – Single pumps (range of applications: multi-family house, commercial applications)

Nominal diameter	Wilo-Stratos...	EEI class	Wilo-TOP-E...	EEI class	Wilo-TOP-S...	EEI class
DN 25 (Rp 1)	25/1-6	A	25/1-7	C	25/5 1~/3~	D/D
	25/1-8	A	–	–	25/7 1~/3~	D/D
	–	–	–	–	25/10 1~/3~	D/D
	–	–	–	–	25/13 1~/3~	F/F
DN 30 (Rp 1 ¼)	30/1-6	A	30/1-7	C	30/4 1~/3~	D/D
	30/1-8	A	30/1-10	C	30/5 1~/3~	D/D
	30/1-12	A	–	–	30/7 1~/3~	D/D
	–	–	–	–	30/10 1~/3~	D/D
DN 32	32/1-12	A	–	–	–	–
DN 40	40/1-4	A	40/1-4	C	40/4 1~/3~	D/D
	40/1-8	A	40/1-10	B	40/7 1~/3~	D/C
	40/1-12	A	–	–	40/10 1~/3~	D/C
	–	–	–	–	40/15 1~/3~	D/D
DN 50	50/1-8	A	50/1-6	C	50/4 1~/3~	D/D
	50/1-9	A	50/1-7	B	50/7 1~/3~	C/C
	50/1-12	A	50/1-10	B	50/10 1~/3~	C/C
	–	–	–	–	50/15	C
DN 65	65/1-9	A	65/1-10	B	65/7 1~/3~	C
	65/1-12	A	–	–	65/10 1~/3~	C
	–	–	–	–	65/13	C
	–	–	–	–	65/15	C
DN 80	80/1-12	A	80/1-10	B	80/7 1~/3~	C
	–	–	–	–	80/10	C
	–	–	–	–	80/15	C
	–	–	–	–	80/20	C
DN 100	100/1-12	A	100/1-10	B	100/10	C

Glandless pumps

EEI classification – Single pumps (range of applications: multi-family houses, commercial applications) (continued)

Nominal diameter	Wilo-TOP-D...	EEI class	Wilo-TOP-RL...	EEI class
DN 25 (Rp 1)	–	–	25/7.5	E
DN 30 (Rp 1 ¼)	30 1~/3~	G/F	30/4	D
	–	–	30/6.5	E
	–	–	30/7.5	E
DN 32	–	–	–	–
	–	–	–	–
DN 40	40 1~/3~	E/E	40/4	D
	–	–	–	–
DN 50	50 1~/3~	E/E	–	–
	–	–	–	–
DN 65	65 1~/3~	E/E	–	–
DN 80	80 1~/3~	E/E	–	–
DN 100	100 1~/3~	E/E	–	–
DN 125	125	D	–	–

EEI classification – double pumps (field of application: multi-family house, commercial applications)

Nominal diameter	Wilo-Stratos-D....	EEI Class	Wilo-TOP-ED...	EEI Class	Wilo-TOP-SD...	EEI Class
DN 25 (Rp 1)	–	–	–	–	–	–
DN 30 (Rp 1 ¼)	–	–	–	–	30/5 1~/3~	D/D
DN 32	32/1-8	A	32/1-7	C	32/7 1~/3~	E/D
	32/1-12	A	–	–	32/10 1~/3~	D/D
DN 40	40/1-8	A	40/1-7	C	40/3 1~/3~	E/D
	40/1-12	A	40/1-10	B	40/7 1~/3~	D/D
	–	–	–	–	40/10 1~/3~	E/C
	–	–	–	–	40/15 1~/3~	E/D
DN 50	50/1-8	A	50/1-6	C	50/7 1~/3~	F/D
	50/1-12	A	50/1-7	B	50/10 1~/3~	E/D
	–	–	50/1-10	B	50/15	D
DN 65	65/1-12	A	65/1-10	B	65/10 1~/3~	F/D
	–	–	–	–	65/13	D
	–	–	–	–	65/15	D
DN 80	80/1-12	A	80/1-10	B	80/7 1~	F
	–	–	–	–	80/10	D
	–	–	–	–	80/15	C
	–	–	–	–	80/20	C
DN 100	–	–	–	–	–	–
DN 125	–	–	–	–	–	–

Wilo-Stratos / Stratos-Z / Stratos-D / Stratos-ZD

Planning guide:
Wilo-Stratos/Stratos-Z/Stratos-D/Stratos-ZD
Wilo-Stratos is the first high-efficiency pump in glandless design with the following advantages:
- Up to 80% electricity savings compared to standard pumps
- For all heating, air-conditioning and cooling systems in the temperature range of -10 °C to +110 °C
- Automatic adjustment of pump output to continuously varying load conditions of the hydraulic system
- Prevention of flow noise
- Safety and comfort during installation and operation

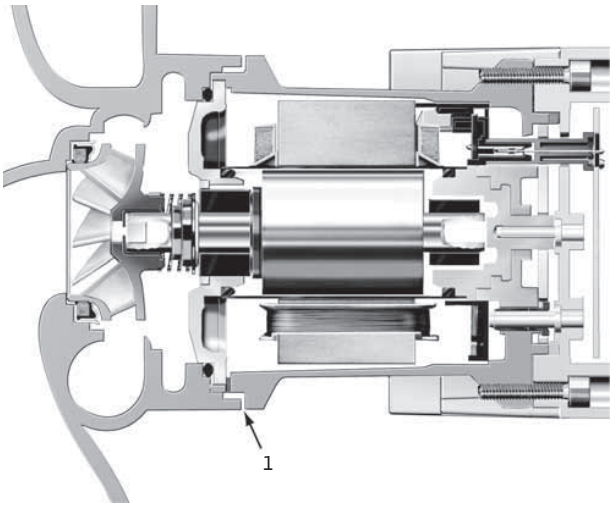
Field of application
The Wilo-Stratos series is used as a high-efficiency pump in circulation systems for heating, ventilation and air-conditioning systems in commercially-used residential and functional buildings:
- Large residential buildings
- Apartment blocks
- Residential complexes
- Hospitals
- Schools
- Administrative office buildings
- Real estate developments

Temperature range
Fluid temperature range of -10 °C to +110 °C without restriction at an ambient temperature of -10 °C to a maximum of +40 °C.

Heating application
In nearly all circulation systems, correctly sized controlled glandless pumps ensure adequate heat supply at all times at significantly reduced energy costs, while at the same time preventing noise generation.
Controlled heating circulation pumps have been mandated by law under the German energy savings ordinance (EnEV)since 01.01.2002 for a nominal thermal output exceeding 25 kW.
Due to its corrosion-resistant pump housing made of red brass, the Wilo-Stratos-Z pump is particularly suitable for installations with possible oxygen entry such as floor heating systems made of plastic tubing.

Thermal insulation for heating
The Wilo-Stratos/-Stratos-Z single pump series are equipped as standard with a thermal insulation shell for the prevention of heat losses through the pump housing. The PP material used, foamed polypropylene, has the following properties:
- Environmental compatibility: easily recyclable
- Thermal resistance: up to 120 °C
- Heat transmission coefficient: 0.04 W/mK in accordance with DIN 52612
- Flammability: Class B2 in accordance with DIN 4102 (normal flammability)
  Normally flammable materials are permitted for use in heated rooms in Germany in accordance with fire prevention regulations as long as a minimum clearance of 20 cm is maintained between them and the fireplace.

Air-conditioning/cooling application
The restriction for conventional variable speed pumps in terms of the dependency of the fluid temperature on the ambient temperature does not apply to the Wilo-Stratos pump.
Condensation forms on cold surfaces if the fluid temperature is lower than the ambient temperature. The Wilo-Stratos pump can also be used in such cases. It is designed in such a way that damage to electrical parts caused by condensation water is avoided.



1 Drain labyrinth for condensation water

Insulation for air-conditioning/cooling
If the pump housing is given diffusion-proof insulation onsite, the insulation may not cover the drain labyrinth between pump housing and motor. That ensures that any condensate having possibly accumulated in the motor can drain off freely through the condensate drain openings in the motor housing.
The diffusion-proof Wilo-ClimaForm insulation available as accessory for the Wilo-Stratos series for the purpose of insulating pump housings in cold water applications ensures this automatically due to its specific design.

Corrosion-proof pump design
Corrosion-proof designs are required for e.g. cooling ceilings or ceiling heating panels. For these applications, the pump housing is coated.
As an alternative, the Wilo-Stratos-Z with its corrosion-resistant pump housing made of red brass can be used as the highest-quality version available.

Wilo-Stratos / Stratos-Z / Stratos-D / Stratos-ZD

Secondary hot water circulation application (Wilo-Stratos-Z/Stratos-ZD)

Pumps which are used in secondary hot water circulation systems are subject to specific requirements that are fulfilled by the Wilo-Stratos-Z/Stratos-ZD series:

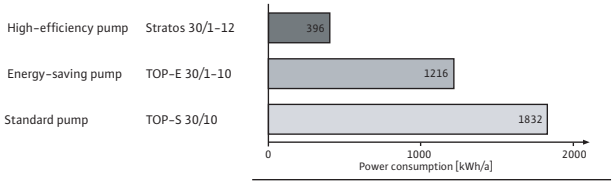
- The fluids are potable water and water for food-processing companies in accordance with TrinkwV 2001 (German drinking water ordinance). Any formation of lime deposits is taken into account by the design, meaning that a total carbonate hardness of 20°dH is permissible at a max. fluid temperature of +80 °C.
- All plastic parts that come into contact with the pumped fluid comply with KTW recommendations.
- The differential pressure control modes Δp-c and Δp-v enable the automatic adjustment of the pump output in volume flow-variable secondary hot water circulation systems with thermostatically controlling line shut-off valves.
- The manual control mode enables the optimum manual adjustment of the pump output to the constant volume flow circulation system. This can be done with the Wilo-IR-Monitor/IR-Module for example. The criterion for this is the temperature of the secondary hot water in the circulation pipe, which must not be more than 5 K below the storage temperature when it enters the secondary hot water storage tank.

High-efficiency pumps

The efficiency of the hydraulics and motor determine the pump's overall efficiency. Both components were doubled with the Wilo-Stratos pump compared to the glandless pumps previously used in building services, thus resulting in a considerable improvement. The applied ECM technology drastically reduces the annual power consumption, That results in considerable savings compared to conventional pumps.

Annual power consumption of a heating pump (DN 30) with setback operation*

Comparison of different pump types



* Load profile with 5500 operating hours per year:
2% (110 hrs.) at 100% Q_N (peak load)
25% (1375 hrs.) at 65% Q_N (partial load)
40% (2200 hrs.) at 30% Q_N (low load)
33% (1815 hrs.) setback operation

ECM technology

The new ECM technology is the basis for the outstanding efficiency of Wilo-Stratos pumps. It includes:

EC motor

EC stands for electronically commutated motor. Its basis is a synchronous motor with permanent magnet rotor. The rotating stator's magnetic field is generated by electronic commutation, meaning that the stator windings are activated specifically for the interaction of the electrical and magnetic poles.

Comparison of the motor components

Wilo-TOP-E with AC motor

Wilo-Stratos with EC motor

This has the following benefits:

- The magnetic field required in the rotor does not need to be generated with any losses.
- Especially in the partial load range (up to 98% of the operating time), the difference in efficiency is even greater than it already is in the full load range compared to an asynchronous motor.
- Higher speeds are possible compared to an asynchronous motor. This results in the reduction of the size and weight of the pump with similar hydraulics.

Wet rotor encapsulation

The rotor of the glandless pump motor runs in the fluid. This fluid lubricates the bearings and cools the motor. The current-carrying stator is separated from the fluid by a can, referred to as wet rotor encapsulation. This wet rotor encapsulation has a direct effect on the efficiency

- due to the size of the necessary gap between stator and rotor,
- and due to the magnetic resistance of the selected can material.

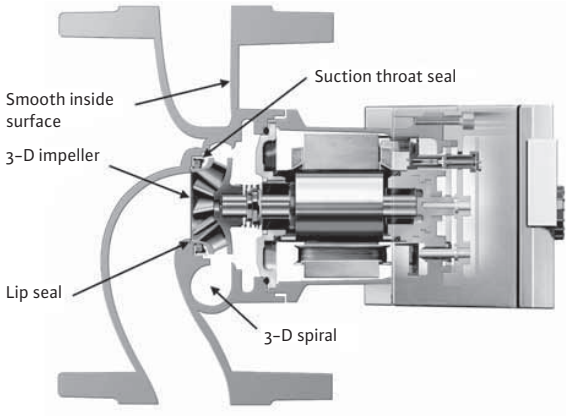
The improvement in terms of efficiency of the Wilo-Stratos pump here is the result of:

- Reduction of the air gap and
- Application of an innovative can material with smaller losses to the magnetic flux between stator and rotor.

Hydraulic optimisation

The hydraulic conditions are optimised by means of a 3D spiral housing and 3D impeller as well as a smooth surface in the pump housing (cataphoretic coating). The suction throat seal between impeller and pump housing reduces radial gap losses. Axial losses are reduced by the sealing lip on the front side of the impeller.

Wilo-Stratos / Stratos-Z / Stratos-D / Stratos-ZD

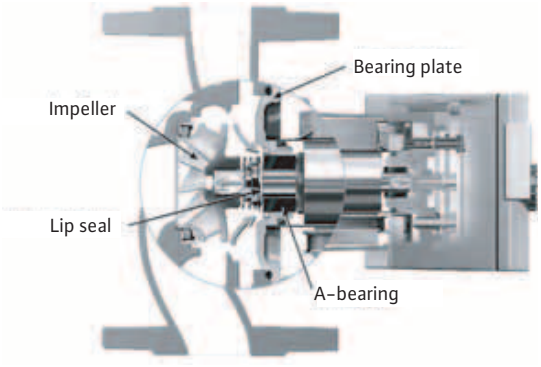


Automatic performance control
The volume flow pumped through a circulation pump depends on the thermal output/cooling output requirement of the system being supplied.
This requirement varies according to:
- Climatic changes
- User behaviour
- External heat influence
- Influence of hydraulic control devices, etc.

The circulation pump designed for maximum load conditions is adapted to the relevant system operating status by means of a continuous comparison of the setpoint and the actual value. This automatic control adapts the pump output and thus also the power consumption continuously to actual requirements.
Electricity savings of up to 80% compared to conventional standard pumps can be achieved by the sum of the measures described here implemented with Wilo-Stratos high-efficiency pumps.

Automatic ventilation

The rotor space is ventilated automatically by the filter and flow channel system. As the fluid flows into the rotor space, a filter plug in the shaft and a filter disc in the bearing plate reduce the ingress of the smallest abrasive particles.
The seal between impeller and bearing plate prevents dirt from accumulating in the A-bearing gap on the motor side.



This has the following benefits:
- The automatic ventilation of the rotor space is accelerated, thus reducing both dry-running times and ventilation noise.
- Damage to the radial bearings or to the can is reduced by the filtering feature.

Motor protection

The standard integrated protection device reliably protects the pump, in all settings, against excess temperature, excess current and blocking.
This has the following advantage:
- No external motor protection switch is required. The connecting instructions of the local electricity supply companies are to be observed.

If, in the case of replacement, there is a motor protection switch in the electrical installation that cannot be bridged, then it is to be set to the maximum current specified on the name plate.

Manual control panel

Operating button
The Wilo-Stratos pump is operated by means of the proven red-button technology (one-button operation). The important basic functions can be set easily and safely, directly at the pump.

Non-position-dependent display
Important information during the operation of the pump is indicated at all times by the pump display that is read at the front and is independent of its position. The extension of the manual control panel for special applications is provided by the operating and service unit, Wilo-IR-Monitor, via wireless communication.

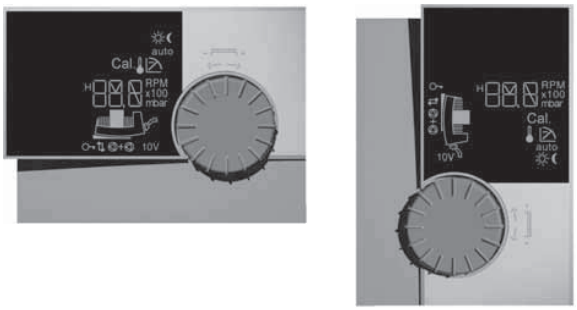


Fig.: All symbols can be read in horizontal or vertical installation

Wilo-Stratos / Stratos-Z / Stratos-D / Stratos-ZD

Control modes

Control mode Δp-c

In Δp-c control mode, the electronic module keeps the differential pressure generated by the pump constant at the set differential pressure setpoint HS over the permissible volume flow range.

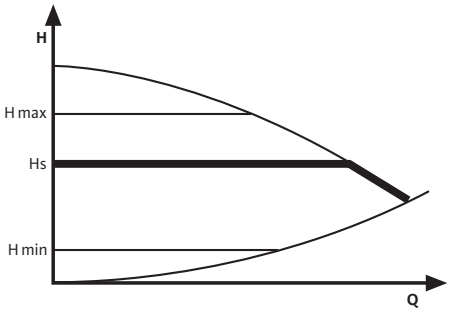


Fig.: Control mode Δp-c

Control mode Δp-v

In Δp-v control mode, the electronic module changes the differential pressure setpoint to be maintained by the pump in linear fashion between Hs and ½ Hs. The differential pressure setpoint value H varies with the volume flow Q.

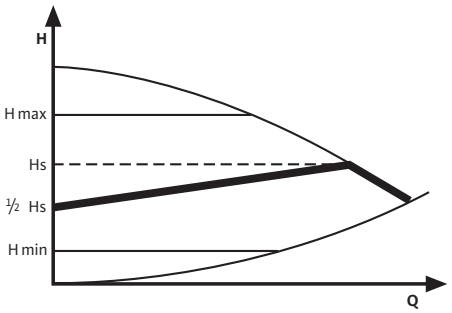


Fig.: Control mode Δp-v

Control mode Δp-T

In control mode Δp-T (programmable with IR-Module, IR-Monitor, LON or CAN), the electronic module changes the differential pressure setpoint to be maintained by the pump according to the measured fluid temperature. This temperature-controlled differential pressure control mode can be used in constant-volume (e.g. single-pipe) systems and variable-delivery systems with varying feed temperature. With the reverse effect, the Δp-T control mode supports the condensing boiler technology, provided the pump is installed in the return pipe of the system.

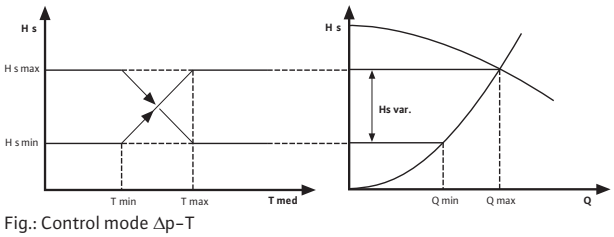


Fig.: Control mode Δp-T

Operating modes

Automatic setback function

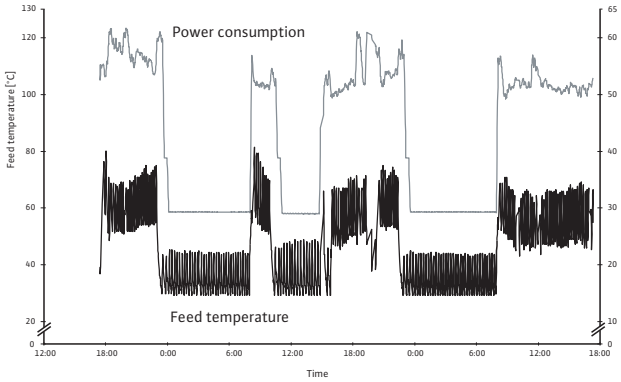


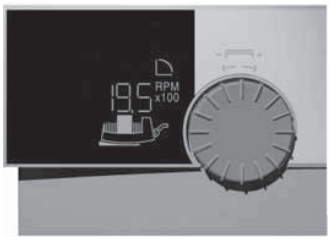
Fig.: Measurement of an electronic pump with automatic setback operation

The patented setback method via fuzzy control enables the further optimisation of the output requirement of the pump under low-load conditions of the heating system. During times when the pump performance is not required (when the heating water reaches a specific lower temperature, e.g. due to the reduction of the feed temperature by the weather-controlled/time-controlled heating controller), the pump switches to a reduced constant speed.
This has the following advantage:

- This operating mode offers additional savings of up to 25 % compared to conventional heating circulation pumps with infinitely variable control.

Manual operating mode

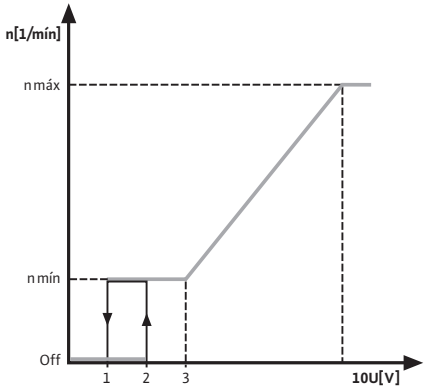
The manual operating mode deactivates the control function in the electronics module. The pump speed can be manually set to a constant value (for the setting range, see the pump motor data).



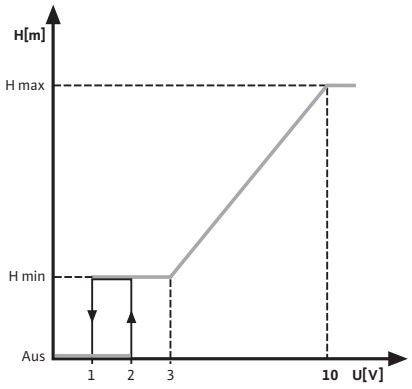
Wilo-Stratos / Stratos-Z / Stratos-D / Stratos-ZD

DDC operating mode
During DDC operation, the comparison of the actual value/setpoint required for controlling is performed by an external controller. An analogue signal (0 – 10 V) is supplied to the Wilo-Stratos pump from the external controller as a correcting variable. The current speed is shown on the pump display, manual operation of the pump is deactivated.

Required accessories: Stratos IF-Module (see also Chapter: "Wilo-Control pump management systems").



Remote setpoint adjustment operating mode
The setpoint for controlling the internal differential pressure (Δp-c, Δp-v) is preset for the Wilo-Stratos pump by an analogue signal, 0 – 10 V. Required accessories: Stratos IF-Module (see also Chapter: "Wilo-Control pump management systems").



BA connection
The Wilo-Stratos pumps have standard and optional interfaces for connection to external monitoring units (e.g. BA building automation or DDC installations).

Collective fault signal, SSM
A collective fault signal is available as potential-free contact, designed as NC contact in accordance with VDI 3814.
Contact load:
- Permitted minimum: 12 V DC, 10 mA,
- Permitted maximum: 250 V AC, 1 A.

The contact is closed under the following conditions:
- The pump is without current
- There is no fault
- Total failure of the control module

The contact is open under the following conditions:
- The pump is powered and there is one of the following faults:
  - Excess motor temperature
  - Excess control module temperature
  - Excess current
  - Pump blockage
  - Short circuit and earth leakage
  - Faulty contact between motor/control module
  - Mains undervoltage
  - Mains overvoltage
  - Electronics faults

Accessories

Stratos Modbus IF-Module
(also see Chapter: "Wilo-Control pump management systems")
Retrofit module for retrofitting with serial, digital interface Modbus RTU for connection to a BUS system RS485 and dual-pumps interface for communication with additional IF-Module Stratos DP.

Stratos BACnet IF-Module
(also see Chapter: "Wilo-Control pump management systems")
Retrofit module with serial, digital interface BACnet MS/TP for connection to a BUS system RS485 and dual-pump interface for communication with additional IF-Module Stratos DP.

IF-Module Stratos CAN
(also see Chapter: "Wilo-Control pump management systems")
Retrofit module with serial, digital interface CAN for connection to a BUS system CAN and dual-pump interface for communication with additional IF-Module Stratos DP.

IF-Module Stratos LON
(also see Chapter: "Wilo-Control pump management systems")
Retrofit module with serial, digital LON interface for connection to LONWorks networks and double pump interface for communication with an additional Stratos PLR IF-Module.

IF-Module Stratos PLR
(also see Chapter: "Wilo-Control pump management systems")
Retrofit module with serial, digital PLR interface for connection to the BA building automation via Wilo interface converter or onsite coupling modules and double pump interface for communication with an additional Stratos PLR IF-Module.

IF-Module Stratos DP
Retrofit module for dual-pump communication.

IF-Module Stratos Ext. Off
(also see Chapter: "Wilo-Control pump management systems")
Retrofit module with control input "Overriding Off", control input 0 – 10 V and dual-pump interface for communication with additional IF-Module Stratos PLR.

IF-Module Stratos Ext. Min
(also see Chapter: "Wilo-Control pump management systems")
Retrofit module with "Overriding Min." control input (setback operation without Autopilot), 0 – 10 V control input and double pump interface for communication with an additional Stratos PLR IF-Module.

IF-Module Stratos SBM
(also see Chapter: "Wilo-Control pump management systems")
Retrofit module with "SBM" collective run signal, 0 – 10 V control input and double pump interface for communication with an additional Stratos SBM IF-Module.

Wilo-Stratos / Stratos-Z / Stratos-D / Stratos-ZD

IF-Module Stratos Ext. Off/SBM
(also see Chapter: "Wilo-Control pump management systems")
Retrofit module with "Overriding Off" control input, "SBM" collective run signal and double pump interface for communication with an additional Stratos Ext. Off/SBM IF-Module.

Dual pump management

With the new high-efficiency pumps, automatic double pump control is possible without an external control device. Required accessories: 2 Stratos IF-Modules (for optional module combinations, see catalogue section: "Wilo-Control pump management systems").
The following operating modes are possible due to the intelligent dual pump management system with one Wilo-Stratos-D double pump or two Wilo-Stratos single pumps:

- **Standby operation**
  The version-specific pump output is provided by one pump, the other pump remains available on standby for time-actuated (24 hours of pure operating time) or fault-actuated switchover.
  Standby operation can be performed by all double pumps and all single pumps (2 x identical type).

- **Parallel operation (in manual control mode only, n = const.)**
  The version-specific pump output is provided by both pumps in parallel operation. The power adjustment is achieved by the synchronous operation of both pumps. Parallel operation can be performed by all double pumps and all single pumps (2 x identical type).

- **Efficiency-optimised peak-load operation**
  During peak-load operation, the hydraulic output is split up between both units of the double pump. During low-load operation (only the base-load pump is running) the second pump is ready on standby. The peak-load pump is also cut in during efficiency-optimised operation if load conditions require a higher pump output. Efficiency-optimised cut-in takes place when the total power consumption P_1 of both pumps is below the power consumption P_1 of one pump. From this point onwards both pumps are run up synchronously to their maximum speed (nominal speed).
  Time-dependent pump cycling (24 hours of pure operating time) assigns the basic-load function to the pumps alternately. This operating mode (load-sensitive activation/deactivation) achieves additional energy savings compared to conventional peak-load operation.
  Efficiency-optimised peak-load operation is possible with all double pumps, as well as with two identical single pumps, if an equivalent double pump type exists.

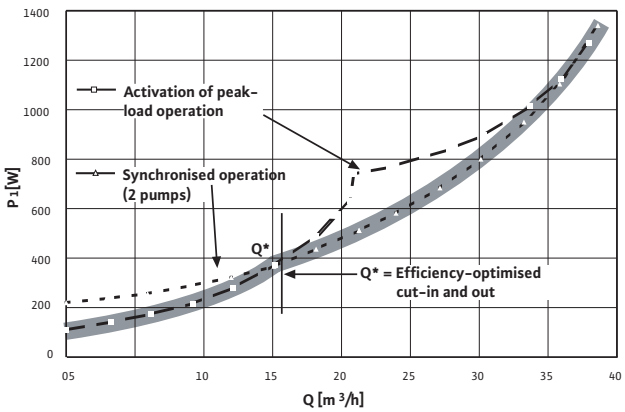


Fig.: Efficiency-optimised peak-load operation

Infrared monitoring

The Wilo-Stratos pumps are equipped with a powerful IR interface for wireless remote control and remote diagnosis.

Fig.: Wilo-IR-Module

All basic functions of Stratos pumps can be simply adjusted directly at the pump via the manual control panel (one-button operation). The IR-Module is available in combination with a commercially available PDA/Pocket PC or the self-sufficient IR-Monitor as operating and service units for IR communication. Both devices provide important additional functions that go beyond the actual pump capabilities.

The Wilo-IR-Module operating and service units (with PDA/Pocket PC) or Wilo-IR-Monitor for:
- Inaccessibly installed pumps
- Extensive operating information
- Detailed fault diagnosis
- Statistical functions
- Special settings/control modes for special requirements
- Protection against unauthorised access
- Rotation monitoring unit for all pumps and standard motors (only IR-Monitor)
- Storage of pump data records (only IR-Module with PDA/Pocket PC)

Like the Stratos pumps, the IR-Monitor is equipped with a one-button control and an LC display. A user program with a graphical user interface runs on the PDA/Pocket PC.

Wilo-Stratos / Stratos-Z / Stratos-D / Stratos-ZD

Application in compact distributors

In narrow spaces, the control module can set in a vertical position by turning the motor. Dimension b4 (see Chapter: “Dimensions, weights”) applies as the minimum clearance (x) for the installation of the thermal insulation shells.

Fig.: Simplified illustration, installation dimensions of additional valves must be taken into account.

Installation and electrical connection

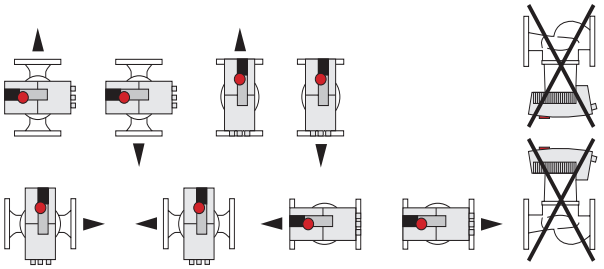
The installation of the Wilo-Stratos pump is uncomplicated, since the flanges are well accessible due to the position of the control module and since the terminal space is also accessible from the front. The pump and module installation positions enable highly variable installations.

All high-efficiency pumps of the Wilo-Stratos/Stratos-Z/Stratos-D/Stratos-ZD series can be connected to the following voltages and frequencies:

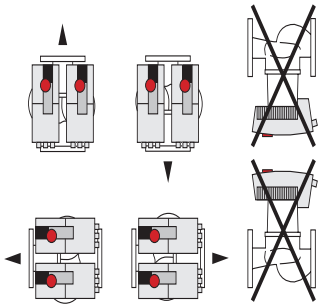
- 1~230 V, 50/60 Hz, tolerance in accordance with DIN IEC 60038 ± 10%
- 3~230 V, 50/60 Hz, tolerance in accordance with DIN IEC 60038 ± 10%

Permitted installation positions

Single pumps:



Double pumps:



Operation on residual-current devices (RCD)

The operation of the Wilo-Stratos series on residual-current devices in accordance with DIN EN 61008-1 is permitted without any impairment of the operation of the residual-current device (DIN VDE 0160). Suitable RCD circuit-breakers are indicated by ⍰ or ⍰.

Wilo-Stratos PICO / ECO-BMS / ECO-Z / ECO-Z-BMS / ECO-ST

Wilo-Stratos PICO, Stratos ECO-BMS, Stratos ECO-Z, Stratos ECO-Z-BMS, Stratos ECO-ST

The Wilo-Stratos PICO and Stratos ECO series with the Stratos ECO-BMS, ECO-Z, ECO-Z-BMS and ECO-ST variants supplement the Wilo-Stratos series mentioned above, with the following advantages:

- Up to 80% energy savings compared to standard pumps
- Stratos PICO and ECO-BMS version for all heating systems in the temperature range +2 °C (+15 °C with ECO) to +110 °C
- Stratos ECO-ST version for solar thermal systems in the temperature range of +15 °C to +110 °C
- Automatic adjustment of pump output to continuously varying load conditions of the hydraulic system
- Prevention of flow noise
- Safety and comfort during installation and operation

Field of application

The Wilo-Stratos PICO, ECO-BMS and ECO-ST series are suitable for use a high-efficiency pumps in circulation systems for heating and in solar systems in 1-6 family houses.

Temperature range

Media temperature range from +2 °C (+15 °C with ECO) to +110 °C with ambient temperature from 0 °C to max. +40 °C.

Heating application

The corrosion-resistant pump housing made from red brass means that the Wilo-Stratos PICO in the RG version is particularly suitable for systems where oxygen entry is possible, e.g. underfloor heating with heating surfaces made from plastic tubing.

Thermal insulation for heating applications

To avoid heat losses via the pump housing, the pumps in the series Wilo-Stratos PICO/ECO (except Stratos ECO-ST) are fitted with a thermal insulation shell as standard. The EPP material used (foamed polypropylene) has the following properties:

- Environmental compatibility: easily recyclable
- Thermal resistance: up to 120 °C
- Heat transmission coefficient: 0.04 W/mK in accordance with DIN 52612
- Flammability: Class B2 in accordance with DIN 4102 (normal flammability)
  Normally flammable materials are permitted for use in heated rooms in Germany in accordance with fire prevention regulations as long as a minimum clearance of 20 cm is maintained between them and the fireplace.

Secondary hot water circulation application (Wilo-Stratos ECO-Z, ECO-Z-BMS)

Pumps used in secondary hot water circulation systems are subject to specific requirements that are fulfilled by the Wilo-Stratos ECO-Z and ECO-Z-BMS series:

- The fluids are potable water and water for food-processing companies in accordance with TrinkwV 2001 (German drinking water ordinance) Any formation of lime deposits is taken into account by the design, meaning that a total carbonate hardness of 20 °d is permissible at a max. fluid temperature of +65 °C.
- All plastic parts that come into contact with the pumped fluid comply with KTW recommendations.

Automatic ventilation

The rotor space is ventilated automatically by the filter and flow channel system. As the fluid flows into the rotor space, a filter plug in the shaft and a filter disc in the bearing plate prevent the ingress of the smallest abrasive particles.
The seal between impeller and bearing plate prevents dirt from accumulating in the A-bearing gap on the motor side.
This has the following benefits:

- The automatic ventilation of the rotor space is accelerated, thus reducing both dry-running times and ventilation noise.
- Damage to the radial bearings or to the can is avoided by the filtering feature.

Motor protection

The standard integrated protection device reliably protects the pump, in all settings, against excess temperature, excess current and blocking.
This has the following advantage:

- No external motor protection switch is required. The connecting instructions of the local electricity supply companies are to be observed.
  If, in the case of replacement, there is a motor protection switch in the electrical installation that cannot be bridged, then it is to be set to the maximum current specified on the name plate.

Manual control panel

Operating button

All versions of the Wilo-Stratos PICO/ECO series are operated using tried-and-tested red-button technology (one-button operation). The important basic functions can thus be safely and comfortably set and adjusted.

Control mode Δp-v

In Δp-v control mode, the electronic module changes the differential pressure setpoint to be maintained by the pump in linear fashion between Hs and ½ Hs. The differential pressure setpoint value H varies with the volume flow Q.

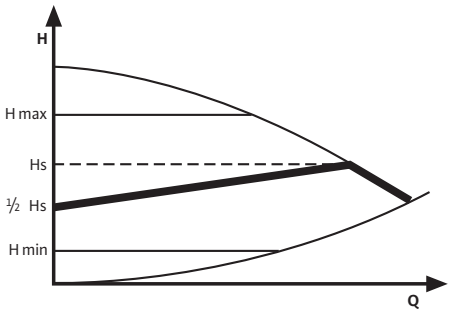


Fig.: Control mode Δp-v

Wilo-Stratos PICO / ECO-BMS / ECO-Z / ECO-Z-BMS / ECO-ST

Control mode Δp-c
(Stratos PICO/ECO-BMS/ECO-ST additionally)
In Δp-c control mode, the electronic module keeps the differential pressure generated by the pump constant at the set differential pressure setpoint HS over the permissible volume flow range.

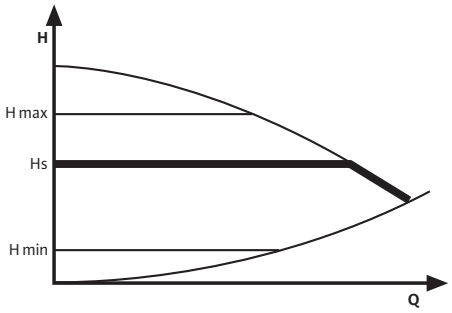


Fig.: Control mode Δp-c

Automatic setback function

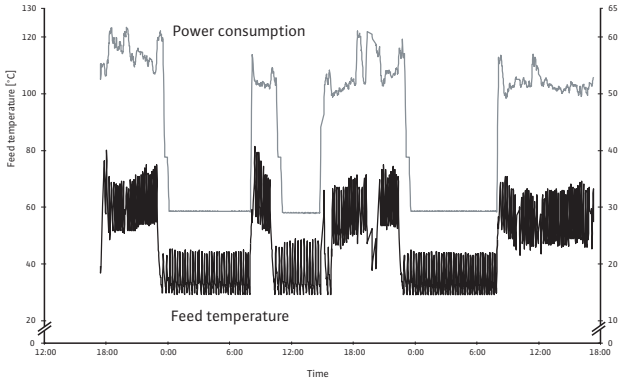


Fig.: Measurement of an electronic pump with automatic setback operation

The patented setback method via fuzzy control enables the further optimisation of the output requirement of the pump under low-load conditions of the heating system. During times when the pump performance is not required (when the heating water reaches a specific lower temperature, e.g. due to the reduction of the feed temperature by the weather-controlled/time-controlled heating controller), the pump switches to a reduced constant speed.

This has the following advantage:
- This operating mode offers additional savings of up to 25 % compared to conventional heating circulation pumps with infinitely variable control.

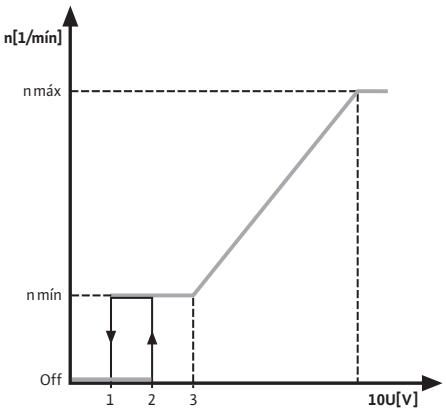
BA connection
(for Stratos ECO-BMS, ECO-Z-BMS and ECO-ST)
For the connection to external monitoring units (e.g. building automation BA or DDC systems), the Wilo-Stratos ECO-BMS, ECO-Z-BMS and ECO-ST versions are standard-equipped with a collective fault signal, the External OFF function and the 0 – 10 V control input.

Collective fault signal, SSM
A collective fault signal is available as potential-free contact, designed as NC contact in accordance with VDI 3814.
Contact load:
- Permitted minimum: 12 V DC, 10 mA,
- Permitted maximum: 250 V AC, 1 A.

The contact is closed under the following conditions:
- The pump is without current
- There is no fault
- Total failure of the control module

The contact is open under the following conditions:
- The pump is powered and there is one of the following faults:
  - Excess motor temperature
  - Excess control module temperature
  - Excess current
  - Pump blockage
  - Short circuit and earth leakage
  - Faulty contact between motor/control module
  - Mains undervoltage
  - Mains overvoltage
  - Electronics faults

Control input, 0 – 10 V
During DDC operation, the comparison of the actual value/setpoint required for controlling is performed by an external controller. An analogue signal (0 – 10 V) is sent to the Wilo-Stratos ECO-BMS/ECO-Z-BMS and ECO-ST as correcting variable from the external controller. As an alternative, a fixed speed can be set locally using the red button.



External OFF control input
Input for potential-free NC contact.
The pump operates in auto control mode when the contact is closed.
An open contact stops the pump.

Note on range of application

This planning guide applies to:
- electronically controlled inline pumps in the series Stratos GIGA, IP-E, DP-E, IL-E, DL-E
- Uncontrolled in-line pumps of the series: IPL, DPL, IL, DL, IPS, IPH-O/-W, IP-Z

Pump selection

Glanded pumps are ideally suited for use in conjunction with large plant systems covering a wide range of applications in the field of hot water and air-conditioning/cooling. The technically correct selection of a pump involves a number of factors:
- The correct pump size to achieve the required duty point
- The correct pump series to fulfil the process parameters (e.g. pressure and temperature)
- The right materials to fulfil endurance requirements.

The overview duty charts in the catalogue section **Series overviews** permit a rough preliminary selection of the series to be made, which means the suitable size can be found more quickly within the series in question. Frequently, pumps of various series are found to be hydraulically suitable in the border area of the duty charts. Accurate selection of the required pump size is possible only with the aid of the individual pump curve. These are provided in this catalogue and in the Wilo planning software (available on CD-ROM and online at www.wilo-select.com).

The **Technical data** section of the catalogue provides information on the application limits with respect to pressure, temperature and material options. In addition, this section of the catalogue provides information on the pump equipment.

Pump curve

An ideally dimensioned pump has its duty point in the region of maximum efficiency. At the duty point, there is a balance between the performance capacity of the pump (figure 1. curve P) and the power consumption required to overcome the resistance of the pipe system (figure 1. curve A1). Tolerances in accordance with ISO 9906, Appendix 1. are to be taken into account for all of the pump curves illustrated.

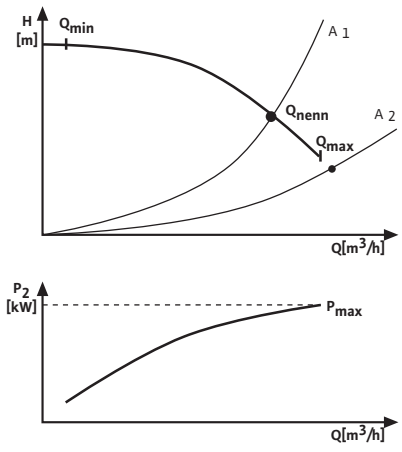


Fig. 1

The point of highest efficiency is approximately in the upper third of the pump curve, or is indicated on the performance diagram. The planning engineer must find a duty point to match the maximum requirements of the pump.

In the case of a heating pump, this is the capacity to meet the calculated standard heating load of the building. All other duty points that occur in practice lie on the pump curve to the left of the duty point $Q_{nominal}$. The pump thus operates within its highest efficiency range. If the actual resistance of the pipe system is lower than that on which the pump selection has been based, then the duty point may lie outside the pump curve (figure 1. curve A_2). This may lead to an unacceptably high power consumption and hence to an overload of the selected motor. In this case it is necessary to redetermine the duty point and, if necessary, use a more powerful pump.

The minimum volumetric flow Q_{min} of a standard glanded pump is 10 % of Q_{max} (Fig. 1).
The minimum volumetric flow Q_{min} of an electronically controlled glanded pump can be calculated using the following formula:

$$Q_{min} = 10\% \times Q_{max\ pump} \times \frac{\text{Actual speed}}{\text{max. speed}}$$

The incremental pump curves provided for pumps and, in particular, for power selection, are intended for use when there is reliable knowledge of the duty point. If reliable knowledge of the duty point is not available, our basic recommendation is to select the pump with the maximum electrical power.

Cavitation

The selection of the right pump also includes the prevention of cavitation. This is particularly the case in open systems (e.g. cooling tower systems) and at very high temperatures and low system pressures. The pressure drop in a flowing fluid, e.g. due to frictional resistance in the pipe, a change in absolute velocity or the geodetic head, leads to the local formation of vapour bubbles when the static pressure falls to the vapour pressure of the fluid (Fig. 2).
The vapour bubbles are carried along by the flow, collapsing suddenly if the static pressure increases again above the vapour pressure (Fig. 3).

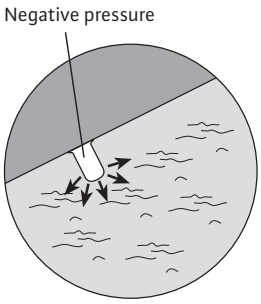


Fig. 2

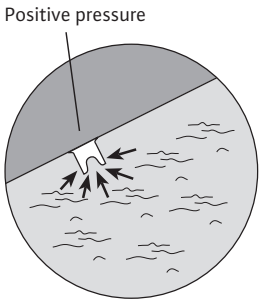


Fig. 3

This process is called cavitation. The collapse of the vapour bubbles causes micro-jets which, on hitting the surface of a wall, cause destruction of the wall material.
To avoid cavitation, special attention must therefore be given to the maintenance of the correct pressure. If the available intake pressure (or static pressure) in the pipe system is not high enough to meet the static head required for the pump (net positive suction head or NPSH), appropriate measures must be taken to increase the static head to at least achieve a balance. This can be done by:
- Increasing the static pressure (pump positioning).
- Reducing the fluid temperature (reduced vapour pressure pD)
- Selecting a pump with a lower net positive suction head (NPSH) (as a rule a larger pump)

Net positive suction head NPSH

The net positive suction head (NPSH) is pump-specific and is displayed in the performance diagram for the pump (Fig.4). The NPSH values are based on the respective maximum impeller diameter. In order to allow for any uncertainty in the specification of the duty point, when selecting the pump, the values should be increased by a **margin of safety of 0.5 m**.

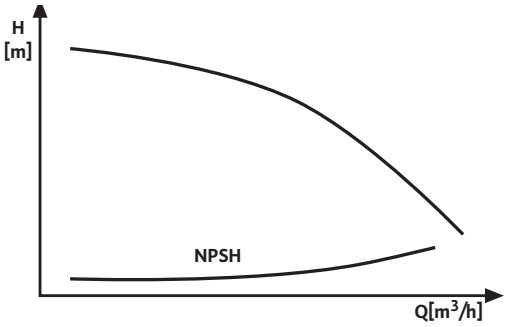


Fig. 4

Series

A hydraulically suitable pump must also meet the required operating conditions. For this, it is necessary to check the maximum permissible operating temperature and pressure first.

Design

In-line pumps

Wilo in-line pumps are single-stage, low-pressure centrifugal pumps incorporating the in-line method of construction with suction pieces and pressure ports of the same nominal diameter and with air-cooled IEC standard motors. Flanges PN 16 with pressure measuring connections R $^{1}/_{8}$. The pump housing is equipped with feet as standard.

Materials

The selection of materials for all parts that come in contact with the fluid is of importance for the chemical resistance of the pump.

The "Materials" table provides an overview of the most important components. In addition to the resistance of glanded pumps, particular significance is attached to the functional capability of the mechanical seal.

Materials

Fluids	Temperature limits	Materials Housing/ impeller		Shaft seal Mechanical seal			Housing seal	
	(the max. permitted operating temperatures and operating pressures for the series must be complied with)	Grey cast iron/grey cast iron	Grey cast iron/bronze or plastic [1]	Standard: AQEGG	S1: Q1Q1X4GG	S2: AQVGG	EPDM	Viton/HNBR
Heating water (in accordance with VDI 2035) (Conductivity <300 µs, silicates <10 mg/l, solid matter content <10 mg/l)	up to 140 °C	•	–	•	–	–	•	–
Cooling and cold water	up to -20 °C	•	–	•	–	–	•	–
Cooling brine, inorganic, pH > 7.5 inhibited	up to 30 °C	•	–	•	–	–	•	–
Water-glycol mixtures, 20-40 vol.% glycol	-20 °C to 40 °C	•	–	•	–	–	•	–
Water-glycol mixtures, 20-40 vol.% glycol	40 °C to 90 °C	•	–	–	o	–	–	o
Water-glycol mixtures, 40-50 vol.% glycol	-20 °C to 90 °C	•	–	–	o	–	–	o
Water-glycol mixtures, 20-50 vol.% glycol	90 °C to 120 °C	•	–	–	o	–	–	o
Water with oil in suspension	0 °C to 90 °C	•	–	–	–	o	–	o
Mineral oil (Comply with operating regulations relating to explosion protection)	-20 °C to 140 °C	•	–	–	–	o	–	o
Swimming-pool water (Chloride <250 mg/l, install pump upstream of filter)	up to 35 °C	–	o	–	o	–	–	o
Fire water	up to 30 °C	–	o	–	o	–	–	o

• = Standard, o = Special equipment

[1] Plastic impellers standard in series IPL, DPL, IP-E, DP-E, some IPL and DPL have cast iron impeller

Mechanical seal

A **mechanical shaft seal** is fitted as standard in all Wilo glanded pumps (Fig. 5). Mechanical seals are dynamic seals and are used to seal rotating shafts at medium to high pressures. The dynamic sealing area of the mechanical seal consists of two surface-ground, low-wearing faces (e.g. silicon carbide or carbon rings), which are pressed together by axial forces. The slip ring rotates with the shaft, while the counter ring remains stationary in the housing. The rings are pressed together by a spring and the fluid pressure.

Fig. 5

As a rule, there is little or no drip leakage during operation, and no maintenance work is necessary. The average service life, under average operating and water conditions, is between 2 and 4 years. However, extreme conditions (soiling, admixtures and overheating) may drastically reduce the service life.

Important:
Mechanical seals are wearing parts. Dry running is not permissible as it will lead to the destruction of the sealing faces.
The mechanical seal fitted as standard by Wilo can be used for water-glycol mixtures with 20 - 40 vol.% glycol and a fluid temperature of ≤ 40 °C.

Outside the limits of these parameters, silicate precipitation may occur, which could damage the standard seals. Special versions are available on request for use outside these limits. When additives such as glycol are used, or if oil-polluted water is encountered, then in addition to the suitability of the mechanical seal, it may also be necessary to check the performance of the pump (in the case of glycol admixtures exceeding 20% volume proportion).
The following formula can be applied to determine the power requirement P_2 of a pump:

$$P_2 = \frac{\rho \times Q \times H}{367 \times \eta}$$

P_2	Power requirement [kW]
ρ	Density [kg/dm^3]
Q	Volume flow [m^3/h]
H	Delivery head [m]
η	Pump efficiency (e.g. 0.8 at 80%)

Mechanical seals – material identification code

The materials of a mechanical seal are identified by means of a 5-part code. The "Technical data" tables for the glanded pumps contain the code for each series. The code characters relate to the following seal components:

1:	Slip ring
2:	Counter ring
3:	Secondary seals
4:	Spring
5:	Other components

Typical materials:

1:	**A**	Carbon-graphite (antimony impregnated)
	B	Carbon-graphite (synthetic resin impregnated) , approved for use with foods
	Q	Silicon carbide
2:	**Q**	Silicon carbide
3:	**E**	EPDM
	E3	EPDM, approved for use with foods
	V	Viton
	X4	HNBR
4:	**G**	Stainless steel
5:	**G**	Stainless steel

The standard seal in Wilo glanded pump is **AQEGG**. It is used for heating water acc. to VDI 2035, cooling and cold water as well as water/glycol mixtures with 20–40 % glycol by volume, up to 40 °C. In water/glycol mixtures with temperatures > 40 °C up to 120 °C or 50 % glycol by volume and temperatures from -20 °C to 120 °C, the Q1Q1X4GG variant is recommended.

Cataphoretic coating

Wilo glanded pumps are provided as standard with cataphoretic painting (exceptions: Series IPS, IPH-O, IPH-W, IP-Z). External components which are susceptible to corrosion such as hexagon head bolts, couplings etc., are chromated. The advantages of these coatings lie in their resistance to corrosion caused by aggressive atmospheres, such as humid air, condensation and an environment containing salt and chemicals. To prevent rust, pumps with cast components with a cataphoretic coating and chromated components are suitable for heating and air-conditioning/cooling applications both indoors and outdoors (a special motor is required for outside applications). These pumps also offer the advantage of low maintenance costs and a longer service life.

Installation notes

Installation site

The standard pumps must be installed where they are protected against the weather, in a frost and dust-free location with good ventilation and without a potentially explosive atmosphere.

Installation positions

Pipes and pumps are to be installed in a stress-free condition. The pipes must be mounted in such a way that the pump does not bear the weight of the pipe. A settling section must be provided before and after the pump, in the form of a straight pipe. The length should be at least 5 x DN of the pump flange (Fig. 6). This measure serves to avoid flow cavitation.

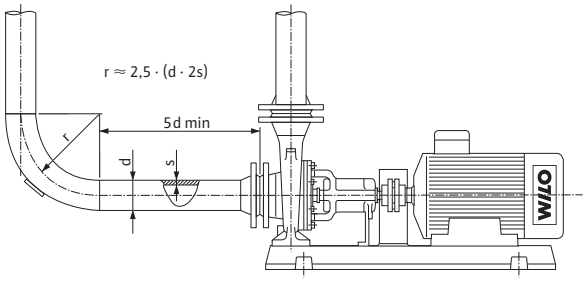


Fig. 6

Inline pumps are designed for direct installation in horizontal and vertical pipes (Fig. 7). Installation with the motor and the terminal box facing downwards is not permitted. If the direction of flow of the fluid is downwards, the motor must be rotated by unfastening the fastening screws. Do not damage the housing seal when doing this. The bleed valve of the pump must always point upwards.

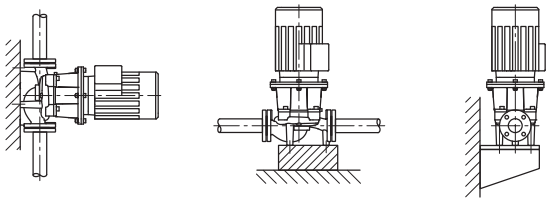


Fig. 7

From a motor power of 18.5 kW onwards, pumps are only allowed to be installed with a vertical pump shaft (Fig. 8). Vertically installed pumps must be supported on the pump bases, preferably on a concrete foundation.

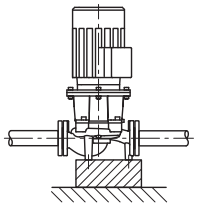


Fig. 8

Installing pumps on a base

Setting up the pump on a flexibly mounted foundation can improve the insulation of the building against structure-borne noise. In order to protect the pump when stationary against bearing damage due to vibration from other units (e.g. in a system with several redundant pumps), each pump should be set up on its own foundation. If pumps are mounted on building floors then it is essential to recommend a flexible mounting. Particular care must be taken with variable speed pump. It is recommended – taking into account all constructionally and acoustically relevant criteria – that a qualified building acoustics specialist be given the task of configuration and design where necessary.

The flexible elements shall be selected according to the lowest excitation frequency. This is usually the rotation speed. In the case of variable speed, assume the lowest rotation speed. The lowest excitation frequency should be at least twice as much as the inherent frequency of the flexible mounting, so that an insulation level of at least 60 % is achieved. Therefore, the spring resilience of the flexible elements must be smaller the lower the rotation speed. In general, it is possible to use natural cork panels at a rotation speed of 3000 rpm and more, rubber/metal elements at a rotation speed between 1000 and 3000 rpm and coil springs at a rotation speed below 1000 rpm. In terms of the configuration of the foundation, care should be taken to avoid any acoustic bridges being formed by plaster, tiles or secondary structures since these will invalidate or significantly reduce the insulating effect. In the case of pipe connection, it is necessary to take account of the flexure of the flexible elements under the weight of the pump and foundation. Planning engineers and installation companies must take care to ensure that the pipe connections to the pump are completely stress-free in their design and unable to exert any gravitational or vibration influences on the pump housing whatsoever. The use of expansion joints represents a good idea in this regard.

Measures against propagation of water and solid-borne noise in pipelines (Fig. 9)

Rubber bellows expansion joints have proven effective as a means of reducing noise propagation in pipelines. To enable the expansion joint to achieve its optimum sound-insulating effect, there must be an adequate fixed point on the side of the pipeline to be protected, and this must be separate from the flexibly mounted foundation. The installation instructions of the manufacturer of the expansion joint must be followed to the letter. When selecting the expansion joint, pay attention to resistance against the temperature and the constituents of the fluid. If necessary, use other constructions instead, e.g. metal bellows expansion joints.

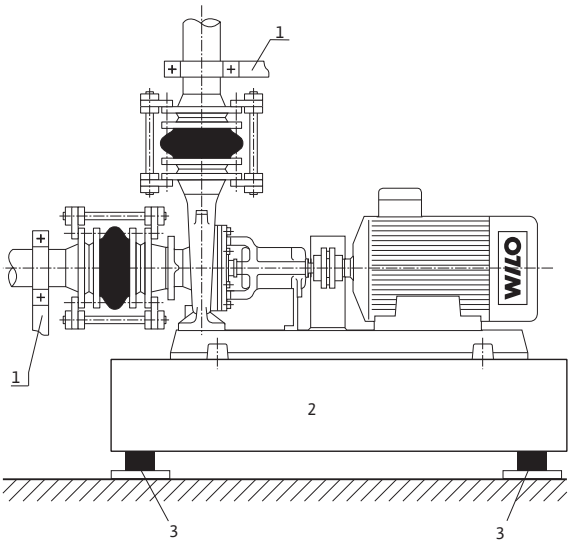


Fig. 9
Key:
1 = Pipeline fixed point
2 = Concrete foundation as settling mass
3 = Spring elements secured with dowels or glued on

Particular acoustic decoupling measures should be taken into consideration in installation locations that are sensitive to noise, such as central roof areas, schools, concert halls or cinemas. Comply with the following regulations, amongst others, regarding the permitted value for noise levels in occupied rooms:

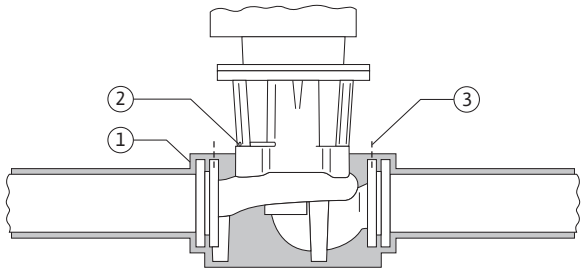
DIN 4109 Sound insulation in buildings
VDI 2062 Vibration isolation
VDI 2715 Noise reduction in warm and hot water heating systems
VDI 3733 Noises from pipelines
VDI 3743 Emissions characteristics of pumps

Spacings and clearances

The pump must be installed in an easily accessible location, so that approved slinging equipment can be used for maintenance work. The minimum axial distance between the fan cover of the motor and a wall of floor must be at least 200 mm plus the diameter of the fan cover.

Heat insulation of pumps

In systems with thermal insulation, it is only permitted for the pump housing to be insulated, not the lantern.



Key:
1 = Thermal insulation
2 = Ventilation
3 = Pressure measuring openings

Anticipated noise levels for inline pumps (for orientation purposes)

Motor power P_N [kW]	Sound-pressure level pA (dB) [1] Pump with three phase motor without speed control				
	Single operation	Double operation	Single operation	Double operation	Single operation
	2-pole pumps		4-pole pumps		6-pole pumps
0.09	54	–	–	–	–
0.12	47	50	50	53	–
0.18	–	–	53	56	–
0.25	54	57	47	50	–
0.37	47	50	58	61	–
0.55	52	54	58	61	–
0.75	60	63	51	54	–
1.1	60	63	53	56	–
1.5	67	70	55	58	–
2.2	67	70	59	62	–
3.0	67	70	59	62	–
4.0	67	70	59	62	–
5.5	71	74	63	66	65
7.5	71	74	63	66	68
11.0	74	77	65	68	–
15.0	74	77	65	68	–
18.5	74	77	71	74	–
22.0	76	79	71	74	–
30.0	79	82	72	75	–
37.0	79	82	73	76	–
45.0	–	–	73	76	–
55.0	–	–	74	77	–
75.0	–	–	72	–	–
90.0	–	–	70	–	–
110.0	–	–	72	–	–
132.0	–	–	72	–	–
160.0	–	–	72	–	–
200.0	–	–	73	–	–

[1] Spatial mean value of sound-pressure levels within a cube shaped measuring area at 1 m from the surface of the motor

Electrical drive

The **rated outputs** and operating values of electric drives specified in this catalogue section for glanded pumps apply to a rated frequency of 50 Hz, a rated voltage of 230/400 V up to 3 kW or 400/690 V from 4 kW, a coolant temperature (CT) of max. 40 °C and an installation altitude up to 1000 m above sea level.
For cases outside these parameters a reduction of the rated output must be applied or a larger motor type or a higher insulation class must be selected.
All Wilo glanded pumps are standard-equipped with electric motors, which meet the IEC standard in terms of output and design. A restriction only applies where, due to the design of the pump, coupling to a standard motor is not possible. In this case, motors with an extended shaft are used. The customary speed categories/operating speeds are as follows:

Number of poles	50 Hz	60 Hz
2	2900 rpm	3500 rpm
4	1450 rpm	1750 rpm
6	950 rpm	1150 rpm

Motors in IE2 technology with greater energy efficiency

From a motor power of 0.75 kW onwards, Wilo glanded pumps are equipped as standard with IE2 motors with higher energy efficiency. Below 0.75 kW motor power, Wilo offers electric motors as standard with optimised degrees of efficiency.

Standard pumps on external frequency converters

When standard pumps are used on external frequency converters, it is necessary to take account of the following aspects with regard to the insulation system and bearings isolated from the flow.

Insulation system:
400 V systems
The motors used by Wilo for glanded pumps are fitted as standard with an insulation system in accordance with the IEC TS 60034-17 standard (fourth edition 2006-05). They are suitable for operation on external frequency converters in all cases, providing the entire installation corresponds to the conditions stated in IEC TS 60034-17.

500 V/690 V systems
The motors which Wilo uses as standard for glanded pumps are not suited to be used on external frequency converters with 500 V/690 V. For use in 500 V or 690 V mains, motors with increased insulation system are available as an option. This must be explicitly indicated when ordering. The overall installation must comply with IEC TS 60034-25 (Second edition 2007-03).

Bearings with flow isolation:
Bearings with flow isolation are **not** required in the IPL, DPL, IL and DL series if the aforementioned conditions for the insulation system are met and the entire system is installed correctly. The following information must be complied with, however:

- The installation instructions from the manufacturer of the converter must be complied with
- The rise times and peak voltages acc. to cable length as given in the corresponding installation and operating instructions must be complied with
- Use a suitable cable with adequate cross-section (max. 5% voltage loss)
- Connect the shielding correctly acc. to the manufacturer's recommendation
- Route data cables (e.g. PTC evaluation) separately from mains cables
- Use a sine-wave filter (LC) if necessary, in consultation with the manufacturer of the converter

Use of explosion-protected pumps according to Directive 94/9/EC (ATEX100a)

Explosive areas are zones in which an explosive atmosphere (gas/dust) can occur in sufficient measure to present a risk.
These areas are divided into zones. Decisions on the assignment of zones lie with the operator and the respective regulation authority.
The testing of pumps (machines) and hence the approval for use in hazardous areas is governed in the EU on the basis of the relevant explosion protection specification 94/9/EC (ATEX100a) by appropriate authorised institutes. Approval is granted by means of a prototype test certificate. Wilo glanded pumps in the series IL, DL, IPL (only variant –N), DPL (only variant -N), IPS and IPH can be supplied according to the specifications for use in potentially explosive areas.
These pumps have a prototype test certificate in accordance with Directive 94/9/EC (ATEX100a), which permits the following designations to be applied:

II 2 G c b II A T3, T4 / II 2 G c b II C T3, T4

CE	**CE marking**
II	Device group
C	Explosive atmosphere due to gases, vapours and mist
c	Design safety (protection due to safe design)
B	Ignition source monitoring with T4

T1 – T4	**Temperature class with maximum surface temperature**
T1	450 °C
T2	300 °C
T3	200 °C
T4	135 °C

E/D	**Motor ignition protection category**
e	Increased safety
d	Pressure-proof enclosure

In this case, note in particular that for applications in the temperature range T4, the pumps and mechanical shaft seals also have to be protected against dry running.
This can take the form, for example, of monitoring the differential pressure or the nominal motor power.

The motors have their own specific designations, e.g. EEX eII T3 which stands for:

S	Motor according to European standard
Ex	Explosion protection
e	Ignition protection category “Increased safety”
II	Motor for potentially explosive areas
T3	Temperature class

and must also be approved in accordance with Directive 94/9/EC (ATEX100a).
The approved operating conditions are listed in the following matrix:

Attention:
Attention must also be paid in each application case to the special features relating to the dependency on temperature, pressure, fluid and mechanical seal. The pumps may only be used for the permitted fluids listed in the following matrix (II B). However, outside the pump, the presence of gases according to the EX groups and temperature classes is permitted (II C).

Matrix of permitted operating conditions for pumps with ATEX approval

Fluid II A	Mechanical seal	Number of motor poles	IL/DL				IPL/DPL	
			Maximum permissible fluid temperature				Maximum permissible fluid temperature	
			T4[1)]		T3		T4[1)]	T3
			P = 10 bar	P = 16 bar	P = 10 bar	P = 16 bar	P = 10 bar	P = 10 bar
Heating water in accordance with VDI 2035	Standard	2-pole	100 °C	90 °C	140 °C	120 °C	120 °C	120 °C
		4-pole	115 °C	110 °C	140 °C	120 °C	120 °C	120 °C
Partially desalinated water with: conductivity > 80 µs, silicates < 10 mg/l, pH value > 9	Standard	2-pole	100 °C	90 °C	140 °C	120 °C	120 °C	120 °C
		4-pole	115 °C	110 °C	140 °C	120 °C	120 °C	120 °C
Mineral oil	G2 / S2	2-pole	75 °C	50 °C	140 °C	115 °C	105 °C	120 °C
		4-pole	95 °C	80 °C	140 °C	120 °C	115 °C	120 °C
Heating water with: Conductivity < 850 µs, Silicates < 10 mg/l, Solid content < 10 mg/l	Standard	2-pole	100 °C	90 °C	120 °C	120 °C	120 °C	120 °C
		4-pole	115 °C	110 °C	120 °C	120 °C	120 °C	120 °C
Condensate	Standard	2-pole	100 °C	90 °C	100 °C	100 °C	100 °C	100 °C
		4-pole	100 °C	100 °C	100 °C	100 °C	100 °C	100 °C
Cooling brine, inorganic; pH value > 7.5, inhibited	Standard		20 °C	20 °C	20 °C	20 °C	20 °C	20 °C
Water with oil contamination	G2 / S2		90 °C	90 °C	90 °C	90 °C	90 °C	90 °C
Cooling water with antifreeze (pH value: 7.5–10; no galvanised components)	Standard		40 °C	40 °C	40 °C	40 °C	40 °C	40 °C
Water-glycol mixture (20% – 40% glycol)	Standard		40 °C	40 °C	40 °C	40 °C	40 °C	40 °C

[1)] Pumps and mechanical shaft seals must be additionally protected against dry running in the T4 temperature range. This can be achieved by monitoring the differential pressure or the nominal power of the motor.

The use of solvents is not permitted, since they could corrode the elastomers in the seals. In turn, this can lead to uncontrolled leakage!

Scope of delivery
Pump, including packaging, installation and operating instructions

Accessories
Electronically controlled in-line pumps:
- IF-Module: PLR or LON for the series IP-E, DP-E, IL-E, DL-E (also see catalogue section “Wilo-Control Pump Management Systems”).
- IF-Module: Modbus, BACnet or CAN for the series IP-E, DP-E, IL-E, DL-E from date of construction 10/2010.
- IR-Monitor for the series IP-E, DP-E, IL-E, DL-E.
- Interface converter analogue (also see catalogue section “Wilo-Control Pump Management Systems”).
- Interface converter digital (also see catalogue section “Wilo-Control Pump Management Systems”).
- Brackets for installation on a base
- Blind flanges for double pumps

Inline pumps without speed control:
- Wilo-Control system for infinitely variable speed control for pump operation according to requirements.
- Switchgears for the automatic control of operating and standby pumps (also see catalogue section "Switchgears and control devices").
- Brackets for installation on a base
- Blind flanges for double pumps

Pump duty splitting

In the context of infinitely variable output control, the "split solution" is available for optimisation, starting with the medium pump output range (1–1.5 kW), i.e. instead of using a large pump, the maximum output is split up between two smaller pump units or a double pump. In the normal case, i.e. for more than 85% of the heating season, one pump is adequate as the basic load unit. The second pump is available to fulfil peak-load requirements.

Attention:
The extra costs for the pumps are more than compensated for by power savings by the control device.

Advantages of pump duty splitting:
- Electricity savings of between 50% and 70%
- A second pump is always available on standby.

With the so-called "split solutions", one pump is operated for basic load requirements, while the other pumps are cut in a parallel circuit for peak load duty.
This ensures that the design requirement is in accordance with DIN 4701. In conjunction with controlled units, continuous adjustment to the load demand can be achieved over the entire performance range.

Attention:
The offers standard-equipped peak-load cut-in for all twin-head pumps or multi-pump systems.

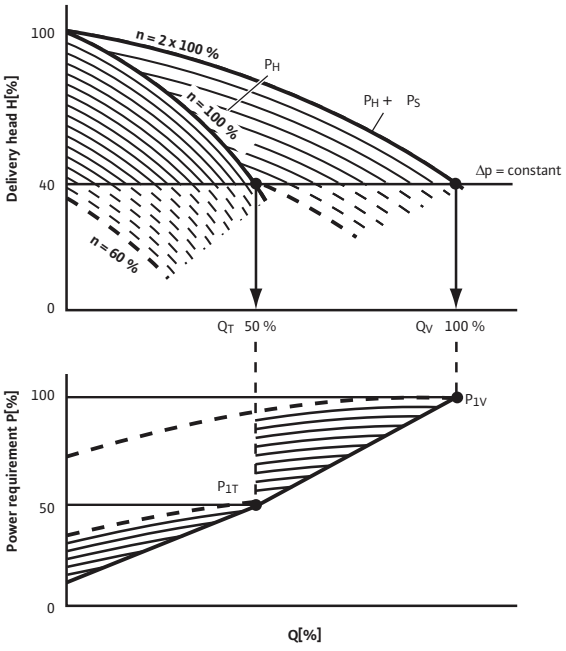


Fig.: Infinitely variable controlled peak-load operation of a double pump with two motor impeller units of equal power.

Key:

P_H	Main pump
P_S	Peak-load pump
Q_V	Full load volume flow
Q_T	Partial load volume flow
P_{1V}	Full load power consumption
P_{1T}	Partial load power consumption

Investment costs
The total investment costs in heating systems can be reduced by almost ¼ using "split solutions". Particularly when use is made of double pumps instead of single pumps, with their very high installation costs (Y-pipes, etc.)

Attention:
Due to their low outlet velocities, Wilo double pumps are particularly suitable for parallel operation.

Operating costs
Considerable reductions in the operating costs also ensue as a result of the large savings in current of the lower performance "split aggregates", since these support better utilisation in the partial load range and, in particular, in the low load range.

Standby
From an operating point of view, there are other advantages, since in the event of a fault in the partial load range or the low-load range, a 100% standby option is available and in the peak-load range, on the few extremely cold days, there is a so-called emergency standby (75%).

Principle of operation
The duty pump and base-load pump are speed-controlled. With the full stabilisation of this unit, i.e. with the nominal pump speed reached and at the start of the peak-load requirement, the peak-load unit is switched on at a fixed speed (nominal speed), while the power of the controlled base-load pump is directly reduced and adjusted to the load point. Resulting pressure fluctuations are relatively minor and in practice have no appreciable effect. During parallel operation, the output of the constant-speed peak-load unit and the controlled base-load unit are added according to the volume flow, which in this operating situation readjusts to the respective peak-load requirement.
The switch-point for cutting in the peak-load pump is determined by means of an internal electronic assessment logic.

Attention:
Peak-load switching of Wilo-Control systems is only possible with control modes according to the differential pressure or differential temperature.
Further information on pump regulation is contained in the catalogue section "Switchgears and control systems".